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HAMILTON P. TRAUB

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THE AMERICAN PLANT LIFE SOCIETY

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TABLE OF CONTENTS

PAGE

Note to Librarians iv
Permission for quotations iv
Citations iv

VOLUME 1, No. 1. APRIL 1945 (PUBLISHED JANUARY, 1946)

[Citations to Vol. 1, no. 1, of PLANT LIFE should read as follows: PLANT LIFE 1 (1945) : —-—. 1946.]

Cover Design, Narcissus time in Ohio, Photo by Carl H. Krippendorf
My introduction to *Narcissus serotinus,* Tom Craig 1
The 1942 and 1943 Narcissus Seasons at Broughshane, Guy L. Wilson 3
Daffodil News Notes, Arno H. Bowers 12
Daffodil Breeding for Amateurs, Sydney B. Mitchell 17
Daffodil Crosses close to the species, Mrs. Kenyon L. Reynolds 23
Tazetta Hybrids, L. S. Hannibal 24
The American Plant Life Society, officers 27

VOLUME 1, Nos. 2 & 3, JULY & OCTOBER, 1945 (Published March, 1947)

[Citations to Vol. 1, nos. 2 & 3, of PLANT LIFE should read as follows: PLANT LIFE 1 (1945) : —-—. 1947.]

Cover Design
The American Plant Life Society, officers; inside front cover
Dedication, First Bromeliaceae Edition 29
André's Bromeliad Collecting in Colombia and Ecuador, Lyman B. Smith 31
The Subfalilies and Genera of the Bromeliaceae, Lyman B. Smith 40
Where Bromeliads are Found, Mulford B. Foster 45
How to Recognize the Bromeliads, Mulford B. Foster 51
A Survey of Bromeliads in Horticulture, Mulford B. Foster and Racine Foster 65
Bromeliads in Southern California, David Barry, Jr. 76
Bromeliads at the Missouri Botanical Garden, Ladislaus Cutak 83
Color in Bromeliads, Racine Foster 94
Bromeliad Time of Flowering Calendar, Racine Foster 96
The Spanish Moss Industry, Wyndham Hayward 97
Biographical sketches—
1. Mulford B. and Racine Foster 99
2. Lyman B. Smith, An autobiographical sketch 100
3. David Barry, Jr., An autobiographical sketch 101
4. Ladislaus Cutak 102
Foster & Foster's "Brazil, Orchid of the Tropics," Betty Carruthers Dill 103

ILLUSTRATIONS

PLATES

Plate 1 Frontispiece portraits—Mulford B. and Racine Foster 30
Plate 2 *Aechmea columnaris* 33
Plate 3 *Puya gigas* 37
Plate 4 One way to obtain bromels 48
Plate 5 *Vriesia itatiaiae* 50
Plate 6 Bromel portraits, nos 1 to 12, incl. 53
Plate 7 Bromel portraits, nos. 13 to 24, incl. 55
Plate 8 Bromel portraits, nos. 25 to 36, incl. 57
Plate 9 *Aechmea phanerophlebia* 63
Plate 10 *Tillandsia fasciculata* 67
Plate 11 Bromeliads in the Foster greenhouse 74
Plate 12 *Quesnalia arvensis* 78
Plate 13 Portrait—David Barry, Jr., and *Nidularium* hybrid 81
Plate 14 Xerophytic bromels in Cactus house at Missouri Botanical Garden 85
Plate 15 *Aechmea pectinata* 91

TEXT FIGURES

Figure 1 André and companion sleeping among bromels in Ecuador 38
Figure 2 Bromel cousins—Spanish Moss and Pineapple 46
Figure 3 *Hohenbergia caatingae* 49
Figure 4 A varigated form of *Bromelia serra* 56
Figure 5 An unnamed *Vriesia* 60
Figure 6 *Aechmea pectinata* and *Nidularium fulgens* 77
Figure 7 *Aechmea Weilmachii* planted deeply to stimulate production of off-shoots 80
Figure 8 Scarlet Torch Plant, *Bilbergia thrysoides* in bloom 89
Figure 9 Portrait—Lyman B. Smith 101
Figure 10 Portrait—Ladislaus Cutak 102

NOTICES

Note to Librarians.—Pages iii and iv, the leaf on which this note appears, together with the title leaf (pages i and ii) that appears at the beginning of no. 1, Volume 1, are to be placed at front when binding no. 1 and nos. 2 & 3. The cover designs are to be left in place.

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The cover design shows a scene during Narcissus time on the estate of Carl H. Krippendorf in the State of Ohio.

MY INTRODUCTION TO NARCISSUS SEROTINUS

Tom Craig, *California*

It was late in October 1943 that I was temporarily stranded in Casablanca with three other war correspondents—Allen Raymond, Barry Farris and Jack Barnett. We were waiting for transportation to take us on to the Italian front.

One afternoon, having nothing better to do, we hired an ancient hackney coach and with a couple of ragged arab boys for drivers, we started out to see the sights. The city was colorful and excitingly exotic. Dark-skinned native men wearing bright robes and red fezes sauntered along languidly or stood about in small groups. Native women with faces veiled moved about quietly and inconspicuously, almost as though hoping not to be seen.

All this interested me very much since it was so different from life at home. The gardens, however, pleased for the opposite reasons—they were full of plants just like we grow in California: Oleanders, Bougainvillea, Plumbago, Bignonia, Lantana, Agave, Parkinsonia, Washingtonia palms, pepper trees and Eucalyptus.

We saw the native quarter, bargained for leather cigaret cases, and ended by driving along the beautiful bathing beaches toward the historic Anfa Hotel, where the Casablanca conference was held. Since I am interested in endemic plants wherever I may be, especially Narcissus, I therefore kept my eyes to the ground as we headed toward the country. Somewhere in Morocco, I knew, were endemic *Narcissus*, particularly the fall bloomers, *N. serotinus* and *N. Broussonetii*, and I was hoping to see at least one of them.

By this time our Rosinante was a bit tired and was taking the steep hill at a lagging pace. The arab boys cracked their whips and screamed encouraging invectives at our skinny and sweating nag. On that hill I first saw them! Scattered about in the field and in the ditches along the road were patches of white six-pointed stars. Without a thought as to what my companions would think, I jumped out over the back of the hack into the ditch to gather a few of these little stars in my hand. This mite of a flower with no foliage and with but a flat vestige of a cup, a miniature fall-blooming Narcissus, was undoubtedly *serotinus*.

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Now, serotinus means more to me than a rare, fall-blooming, Moroccan Narcissus. It brings back memories of a long series of experiences of which this was the first. I saw it a number of times after that—all around the outskirts of Casablanca and not uncommonly around Algiers. It put up its bare flower scape among the tents where our soldiers were camped, in our engineer supply dumps, and along the margins of airfields and roadways—never abundant, but decidedly no great rarity. I never came across it without secretly wondering how its relatives were growing in my Los Angeles garden.

For years I had planned an attempt to bring the Moroccan fall bloomers into the parentage of my Narcissus seedlings in the hope of developing fall and early winter blooming daffodils. Ironically enough, there I was with an abundance of pollen but nothing on which to put it—just another of the annoying fortunes of war. I understand that some breeders are trying to work these Moroccan Narcissus into their hybrids. I hope they will tell us of their results.

THE 1942 AND 1943 NARCISSUS SEASONS AT BROUGHSHANE

GUY L. WILSON, *North Ireland*

[Since the Daffodil Year Book of the Royal Horticulture Society has not been published for several years, due to war conditions in England, many daffodil enthusiasts have missed Mr. Wilson's interesting yearly articles. We are therefore very glad to publish Mr. Wilson's letters on the two past seasons. It should indeed be gratifying to Mr. Wilson to see how these reports have been passed along and eagerly read by the Daffodil planters and growers in America. —*Narcissus Committee.*]

1. SEASON 1942

The bulb harvest of 1941 was late, foliage kept green for longer than usual, and exceptionally fine bulbs were developed; so I looked forward to good flowers in 1942.

Owing to severe and prolonged winter weather in the early months of this year, the season was again very late; so much so that at one period I wondered whether we should manage to get even the bulbs we had potted into bloom in time for the London show. The main interest of late March and early April was in watching these develop, and trying to time them to suit the show date, April 14 and 15. We managed to do this fairly successfully, and had a very nice lot of flowers. I have never seen finer *Flemish:* we had several potfuls, each of which gave six or eight superb flowers. *Leinster* was one of the finest yellow trumpets; *Integrity* also was astonishingly good. Of red cups I find that *Dunkeld* does excellently in pots, coming in first rate form, with good colour. My newer intense yellow and scarlet *Indian Summer,* of which two offsets were potted, also came with brilliant colouring, and was useful in the Engleheart cup class, as was likewise my pink cupped Leedsii *Lisbreen,* which was very good, and can apparently be relied upon to show a definite amount of pinkness. A single offset of *Chinese White* gave a lovely flower which was a strong support in the cup class. Watching these and many others develop under reasonably good conditions, safe from weather damage, before the more hectic and congested rush of the season was, as always, a great delight.

When I left for London, the weather showed signs of improving and things were beginning to move out-of-doors, although as yet there was very little indeed in flower. As Richardson had told me that he was at the peak of his season's bloom, I had small hope of winning anything, so I was surprised and much pleased to win the Engleheart cup, as well as being awarded the medal for the best flower in the show, and winning the only other two classes which I had entered; namely 12 trumpet varieties yellow, white and bicolor, three blooms of each, and 12 large Leedsii, three blooms of each. I think that my good fortune was partly due to the fact that owing to transport difficulties, Richardson had been obliged to leave home a day sooner than I did, and his

flowers were getting just a little bit tired; however, my own when staged were nothing to be ashamed of. My "best flower", which was shown in the Engleheart cup class, was a new and superb 4 A of nearly trumpet measurements and distinct character; in form it rather suggested a giant trumpet-cylamineus hybrid, as the very broad but sharply cut perianth reflexed slightly from the somewhat bell shaped trumpet-crown. The flower which had immense substance and faultless texture was intense icy-white with exquisite green shading at the base of the segments where they join the crown, and in the base of the crown itself. It was bred from *Samite* by *Slemish*, and I named it *Murmansk.*

Richardson had a gorgeous lot of flowers from amongst which some half dozen varieties gained awards of merit. Some of these, of course, had been seen before; e. g., *Narvik* and *Buncrana*, the latter a very fine white and deep apricot orange incomp. of perfect show quality. Two that I had not seen before were a first class incomp. having broad smooth clean cut golden perianth, and not too large, nicely frilled deep orange red cup, a flower of excellent form and habit bred from *Penquite* by *Killigrew;* it was shown under number, and has since been named *Cotopaxi.* The other was a glorious tall strong stemmed rich deep *Trenoon* gold coloured flower, classed as incomp. but bordering on Ajax proportions; splendid in size, build, proportion, stature and colour, it should make a magnificent garden plant as well as a grand show flower; it has since been named *Galway.* Richardson's exhibits seemed especially rich in these magnificent deep yellows. His superb trumpet *Kingscourt* was again shown in great form, whilst a new one named *Gold Digger* was outstanding; it is a large flower of perfect form with broad flat perianth standing erectly at right angles to the somewhat slender neatly flanged trumpet; the texture is smooth and very firm, and the colour quite uniform intense deep gold. Amongst a bewildering display of brilliant incomps. I recall a strikingly effective show flower named *Jerpoint* which had velvet smooth texture and great substance; the broad slightly spoon shaped segments being intense clear yellow, the well proportioned rather bowl shaped cup was also rich yellow edged with a bold and very sharply defined band of brilliant orange scarlet.

My recollection of most other exhibits is foggy, but I clearly recall in Col. George Johnston's Engleheart cup group a most charming and distinct small crowned Leedsii with circular pure white perianth of perfect quality and almost flat solid coral pink crown.

During my absence in London there had been six days of most perfect Spring weather with warm sunshine at home; and when I got back, all except the very latest things and the poets had rushed into full flower, so that I found an overwhelming feast of glorious bloom. I could not help feeling a sense of regret that I had not been here to see them open, and a fear that I should never have time to study their individual beauty. It was a lovely calm day of warm sunshine, and the flowers were in perfect fresh undamaged condition. What a time I had going over them all and selecting some seventy odd seedlings from the seedling beds that afternoon. Never have I seen the whites in such

superb condition. *Truth* and *Kanchenjunga* were quite marvellous, finer than I have ever seen them: some of the flowers of *Kanchenjunga* were of amazing size and perfect form carried on taller stems than usual; while my great white trumpet *Broughshane* again fully justified my opinion of it as the most spectacular thing I have yet raised. Two blooms in particular from strong single nosed bulbs one year down towered head and shoulders above their neighbors, faultless in form and balance, their immense size, beauty and giant foliage were quite arresting.

Yellow trumpets were also magnificent. Brodie of Brodie's *Elgin* was really wonderful, its great rich golden flowers measuring up to 5¾ inches in diameter, being at the same time of fine form, substance and quality. My own *Principal* and *Garron* grew with enormous vigour, but being somewhat later than *Elgin* they scarcely attained the remarkable development which they would have done but for the fact that after a few days of ideal weather, a strong cold harsh and very dry east wind set in which persisted without ceasing, day and night till practically the end of the season, and hindered full development of many of the later flowers, as well as inflicting damage on all but those in exceptionally sheltered spots.

Red cups generally were short of colour, having been rushed out too suddenly to permit their full development. There were, however, several notable exceptions, e. g., *Tinker.* bred from *Damson* by *Rustom Pasha,* which is rather early; this was finer than I have yet had it, being magnificently brilliant. Then there was a small stock of an unnamed seedling from *Market Merry* by *Clackrattle,* from the same batch of seedlings as *Indian Summer:* previously this, though of splendid colour, had been inclined to come a bit rough; but this season it appeared as quite the finest red and yellow Barrii I have ever seen, carrying big tall stemmed circular flowers with very broad smooth clear golden perianth and shallow intense deep vivid red crown, a gorgeous thing, so I have named it *Chunking.*

Flowers having pink tinted crowns were, curiously enough, in most cases better coloured than usual; Brodie of Brodie's little *Wild Rose* in particular was quite startling, its cups being really rosy pink.

Amongst seedlings which had flowered for the first time in 1941, several very good things appeared; notably a most magnificent Leedsii bred from *White Sentinel* by *Kanchenjunga;* an immense flower more than 5 inches in diameter of quite perfect form, balance and quality, having great broad flat smooth pure white perianth and perfectly proportioned widely flanged or bell mouthed finely frilled milk-white crown; this I think is the finest Leedsii of such large size that I have yet seen. Another Leedsii bred from *Gracious* by *Truth,* a tall plant, is a beautiful self white of extraordinary purity; whilst a third bred from *Niphetos* by *Truth* is another pure white of superb texture and faultless modelling.

Amongst a large batch of seedlings flowering for the first time this season the most striking break was a series of very attractive and novel,

large cool clear greeny sulphur lemon trumpets, bred from *King of the North* by pollen of *Content.* Some were almost selfs; others very pale with a marked frill of deeper lemon at the mouth of the trumpet: one or two were actually reversed bicolors; the most striking being a wonderful large trumpet of fine form having bright clear greeny lemon perianth with a whitish halo around the base of the segments where they join the trumpet; the trumpet itself being clear greeny lemon on the outside, and almost white inside, its well serrated brim being tipped with sparkling lemon. Of course it remains to be seen whether these beautiful and interesting flowers will be good doers. Amongst other good flowers were one bred from *Bridal Robe* by *Samite;* a large late white trumpet of noble build and lovely quality having beautiful greenish shading in the base of the trumpet and segments. From *Dunluce* by *Broughshane* came a superfine larger clear pure self white trumpet. From *Hebron* mated both ways with other good yellow trumpets came some very promising rich yellow trumpets. I find that I am getting a relatively large proportion of good results from *Kanchenjunga* as a parent, as from some 141 seedlings in all, selected for further trial 15 have been bred from *Kanchenjunga* pollen and 3 from its seed.

Dry weather from flowering time till the end of June and a late ripening season resulted in magnificent bulbs, so if we get reasonably good weather next April we ought again to see fine flowers.

2. Season 1943

This will be remembered as the year of the south-west wind, in striking contrast to 1941, when from December to June the wind blew from east to north east without a break. This season there has never been any east wind, a circumstance without precedent in my memory; consequently, it has been the most wonderfully beautiful early spring that I have ever known. We had literally no winter at all; nothing more than a few night frosts, and once a sprinkling of soft snow that disappeared in a few hours. It was like the winter of south-west Cornwall or Scilly. The only flaws in this otherwise quite perfect season were several big westerly gales during flowering time, which did some flower damage; but, as the wind was moist and mild, the damage was very much less than would have been inflicted by east wind: and fortunately the main planting of my best flowers was in a position partially sheltered from the prevailing wind.

Snowdrops were in full bloom early in January, and during this month, all my little early Crocuses made full display, while the common yellow Crocus was in flower at the end of the month. *Rhododendron Praecox,* which usually tries to flower here at the end of March and gets spoilt by frost, began to open on January 30th, and gave the best display it has ever done since I have had it. The first bloom of the earliest little golden trumpet daffodil, *Dorothy Bucknall,* was out on January 31st; *Pallidus Praecox* had joined it by February 5th, and sheltered clumps of old double *Telamonius Plenus* in the grass were in bloom during the last week in February. A red and yellow numbered seedling

incomp. was in flower in one of the daffodil beds at the same time, and I selected my first 5 year old seedling, a yellow trumpet on March 1st.

February was a marvelous month: green leaves appeared on thorn hedges in sheltered spots, and during the last week of the month, the common Prunus gave the finest display of blossom I have ever seen from it; and I saw Black-thorn in flower at the same time. Before the end of March, hedges were quite green, and some trees bursting into leaf. In short, the season was 3 weeks to a month early.

The bulb ripening season of 1942 had again been exceptionally favourable, and I had had about the finest bulbs I have ever grown, and so hoped for exceptionally good flowers, given a favourable season in 1943. I have often noted that daffodils grow with great vigour if the spring is late in coming, and they have been somewhat retarded by cold weather. Actually during February and the early part of March I feared that the quite abnormally advanced growth would result in softness and lack of vigour, owing to insufficient sunlight during the short days, and indeed in the case of some things growth did look rather weak at this early stage. However, as the sunlight grew stronger during the lengthening days of March the plants visibly and rapidly gained vigour and strength till by the 10th of April, when they were in mid-season bloom, they were finer than I have ever seen them, indeed quite marvellous.

Lionel Richardson's season in County Waterford is always much earlier than mine, and this year *Forerunner* and *Fortune* were in flower with him in January. I paid him a visit from Friday March 19th till Monday 22nd when his flowers were already about in midseason bloom, and a georgeous feast they provided.

He had one field of fully an acre in extent, completely filled by a few large stocks, notably 12,000 each of *Porthilly* and *Carbineer* which were in their early prime and in perfect condition when I saw them, and what a wonderful sight they were. Both of these will make grand garden plants, as also will be the beautiful Diolite—a flower of faultless quality, grand carriage, and habit, and charming colour: while the beauty and value of *Leedsii Brunswick* cannot be exaggerated, especially in view of its earliness and exceptional power of lasting. *Rustom Pasha* of which there was also a large stock, is perhaps the best red and yellow for garden decoration yet seen, as it's very brilliant colour is quite sunproof, and it is a strong and sturdy plant. Of newer things of Richardson's own raising and seedlings, of course there were abundance to be seen. He excells in red and yellow incomps. A new one named Ceylon is about as brilliant as anything I have yet seen; a well built, shapley flower with smooth perianth of intense aureolin gold and well proportioned dark intense clear orange red crown. A large and brilliant flower named *Sun Chariot* has big broad spreading perianth of intense sunflower yellow, and well proportioned frilled bowl shaped blazing orange scarlet crown: it is quite sun-proof. *Narvik* which is perhaps the best of the splendid *Carbineer* x *Porthilly* series was in very fine form: it has wonderful substance and quality, combined with beautiful

shape and proportion. There was quite a bed of the astonishing *Krakatoa*—Richardson intends to exhibit a spectacular group of it after the war, and it will certainly cause some excitement. It is a flower of largest size, which might be described as a scarlet and gold *Great Warley,* but of better form and substance, with broad intense gold perianth and large frilled, basin shaped, fiercely hot, orange-scarlet crown. There are also other magnificant seedlings as yet un-named.

There are also a set of superb yellow trumpets: of these, *Kingscourt* is perhaps the finest exhibition yellow trumpet I have yet seen; very large, of perfect form and balance, very satin smooth faultlessly overlapping perianth of wonderful thick texture, the whole flower being uniform rich gold. *Goldigger* is also a first class flower like an enlarged and improved *Cromarty,* of intense unfiorm dark gold: white *Galway* is quite magnificant, a taller plant than the others, with very strong stem and grandly formed large flower of pure and brilliant intense deep gold. It will make a glorious garden plant.

At the Dublin Show on March 30th and 31st, Richardson, W. J. Dunlop of Ballymena, and myself all put up gold medal groups which made a very fine display along one side of the Baggotrath Hall. While in Dublin the first of the westerly gales came, and wind was so violent that I was much worried as to the fate of my flowers at home. I got home about mid-night on the 31st and next morning, April 1st to my great relief, I found that surprisingly little damage had been done. From then till about April 6th conditions were perfectly ideal. There was never any lack of moisture, and the daffodils grew with immense vigour: length of stem, size, substance and quality of bloom were all quite wonderful. By Sunday 4th April very many things were in their early prime: it was one of those still balmy April days of heavenly beauty with soft air and gentle sunlight filtered through thin cloud: in the evening the masses of wonderful and perfect flowers seemed to be of quite unearthly beauty.

Never have I seen *Cantatrice* so fine, a crowd of big flowers on tall stems, so smooth in texture that they were like the finest marble. *Askelon* was also finer than I have ever seen it, immense faultless blooms with enormous broad foliage. *Fortune,* by now over its best, was still a thick mass of bloom on towering stems. Of yellows, *Principal* was this year on top of its form it is a really grand all round plant and flower, and will, I am confident, be one of the standard varieties of the future.

One of the outstanding high-lights of the season, both here and at Waterford, was *Trousseau*: it is undoubtedly one of the very finest things ever raised by anyone. It has every virtue—ample stem, grand sturdy habit, perfect carriage, fine size, perfect form and proportion, with its broad, flat perianth, and neatly flanged trumpet, great substance and durability, and marvellous quality. Its satiny white perianth and velvety rosy buff cream trumpet create an effect of extraordinarily rich, but enchantingly delicate loveliness. The flowers attained great

size and perfect development without flaw, and were an almost unbelieveable dream of beauty.

Of coloured things, my grand, large, early gold and orange red incomp. *Armada* was particularly fine. *Tinker*, intense clear yellow and deep orange scarlet, seems to be gaining size and vigour year by year. A bed of little *Leprechaun* opened with jewel-like brilliance, looking lovely with its exceptionally blue green foliage. *Fairy King* was superb, I think larger and finer than I have ever had it.

Amongst newer things and seedlings, my *King of the North* x *Content* greeny lemon trumpets were again most exciting and promise to be a wonderful acqusition: one of them, a lovely smooth flower, opened first early. Brodie's beautiful *Hunters Moon*, a flower of enchanting moonlit sulphur-lemon came superbly indoors. It also grew most vigorously, lasting a quite amazing time in the open, its charming colour being retained till the flower died; so it will make a most desirable garden plant. As it has a good stem, it will also be an ideal cut flower, and altogether promises to be a most important introduction. *No. 30/90*, bred from a seedling from *Quartz* x *Naxos*, by pollen of *Chinese White*, is a Leedsii of perfect form, proportion and pose, fine texture and substance, and purest icy-white with a green base; it is, I think, one of my very best Leedsii up to date. There were several fine flowers bred between *Kanchenjunga* and *Truth* both ways. From *Truth* x *Slemish* came a tall silken smooth trumpet Leedsii of purest self snow-white. Another remarkable Leedsii was bred from *Gracious* x *Broughshane*: this bloomed rather late, and was a very large, grandly built flower, with broad flat perianth and well flanged crown, its stem attaining the astonishing height of 33″.

It was a good pink year, and a little family selected last year from a batch bred from *White Sentinel* by *Evening* were particularly charming: all very neat nicely proportioned flowers. some with well frilled crowns of quite rosy pink. Another from *White Sentinel* by *Carnlough* was a lovely large flower with big, wide spread, smooth, pure white perianth, and nicely proportioned, rather basin shaped crown of the most entrancing delicate shell pink. Radcliff's *Rosairo*, sent from Tasmania, has not yet fully acclimatised, but is very promising: I took a flower to London: it was not exhibited, as it was nearly over, but its colour astonished some who saw it the day before the show.

On Wednesday April 7th came the second of the big westerly gales of the season: the wind blew with such force that several of our strongly fixed shelter covers inside the six foot hop-screening fences became detached; but fortunately, most of our shelters stood up. and damage was very much less than might have been expected, and I was able to collect a grand lot of flowers to take to London on the night of the 10th.

Broughshane, Brodie's *Hunters Moon*, and *Tamino*, which I showed all got Awards of Merit. Nine noble flowers of *Broughshane* arranged in one of the R.H.S.' big glass vases were indeed an impressive sight. To my considerable surprise, I was awarded the medal for the best flower in the competitive classes for a fine *Silver Coin* Leedsii seedling

which I had cut the day before I left home in almost tight bud: it has very broad solid flat white perianth of great substance and velvet smoothness and neat smallish creamy cup, very good strong stem, and short neck. The more important classes I won were Class I for three blooms each of 12 varieties, representing at least 4 Divisions, and the class for 3 blooms each of 6 varieties not in commerce. Amongst the latter I included *Moina*, a charming flower, bred by C. E. Radcliff of Hobart, Tasmania, between *Mystic* and the Australian-raised *Pink Un;* it is a good sized very shallow crowned 4b with broad white perianth and creamy citron white crown, edged with a sharp ribbon of salmon cerise. I also showed an exquisite icy-white trumpet seedling and *Virtue*, an intense deep self lemon yellow of faultless form and quality. My group of 12 large trumpet varieties was, I think, the finest I have yet staged.

Richardson won the Engleheart cup with a magnificent group, amongst which a superb bloom of *Fermoy*, shown in perfect condition, was, I think, the finest red and white incomp. I have seen yet. It is bred from *Niphetos* by a red cup seedling, and inherits much of *Niphetos'* good form and balance. It is a big flower, with broad and wide spread pure white perianth, and perfectly proportioned beautfully frilled clear orange red crown, which is gold in the base. I quite thought that this flower would have been chosen as best in the competitive classes. *Tampico*, in the same group, was a remarkably fine large tall red and white Barrii of beautiful form, bred from *Warlock* by *Forfar;* while the smaller *Mahmoud*, with smooth circular poeticus-white perianth and solid deep red eye, is a brilliant flower of highest quality; and *Innisfallen*, bred from *White Emporer* by *Gracious*, is a pure white and soft chrome bicolour incomp. of faultless form, balance and wonderful quality, rather like a more refined *Polindra*.

As it was only a one day show, and we had a fairly lengthly meeting of the Narcissus Committee, and as there was a very crowded attendance of the public, it was a terribly hectic business, and I found it quite impossible to see a great many of the class exhibits at all, but several very good and promising seedlings were shown by amateur raisers, notably those from Mr. F. E. Gibbs of Hayes, Middlesex, who had two very fine gold incomps. and several other flowers of merit.

After the show, the Richardsons and myself went up to Brodie Castle in Scotland, and found the flowers there in incomparably finer condition than they were last year; but it was sad indeed to go round the garden without Brodie himself. Everything was clearly labelled in his neat handwriting just as he left them, and it was easy to find the parentage of seedlings flowering for the first time in the seedling beds from his carefully kept records. Amongst 4 and 5 year old seedlings there were two very outstanding flowers: one, a glorious large white near-trumpet bred from *Cotterton* by *Broughshane*; *Cotterton* is a rather short stemmed well formed pure ice-white flower, bred from the white trumpet *Tain* by Leedsii *Evening*. The seedling from *Cotterton* by *Broughshane* had very large and broad erect or almost slightly re-

flexing, smooth, pure white perianth, and beautifully proportioned, well flanged trumpet crown; it has great substance, quality, splendid carriage, and good stem. The other notable 5 year old seedling was the most intensely dark gold trumpet I have yet seen: a fine tall plant, the flower being of semi decorative form: it was bred from a dark yellow large crowned near-trumpet of un-known parentage, by pollen of *Maviston.*

I got home again on the 20th April to find most of my early and mid-season flowers pretty well over or past their best, but the later things were still glorious, and their size and length of stem were astonishing. I found *Red Hackle* in magnificent condition: and a seedling of my own which I have named *Gala,* also bred from *Folly* by *Red Abbott,* which were the parents of *Red Hackle,* in finer form than I have ever seen it; indeed, I was much pleased with it—its perianth is almost Poeticus white, just visibly purer than even the very white perianth of *Red Hackle,* while the well frilled crown is blazing orange scarlet with a greenish citron base. My intensely brilliant scarlet and gold *Indian Summer,* which was just opening when I left on the 10th for London, was still in splendid condition and it kept its colour remarkably well.

Amongst seedlings flowering for the first time this season, there did not seem to be anything very startling, though several were promising and will probably improve. There were one or two good first early rich gold trumpets; one bred from *Magnificence* by *Hebron* was of good form, carriage, and very rich deep colour. Two or three beautiful deep clear gold trumpets came from *Hebron* by pollen of Richardson's *Goldcourt.* A 4 year old seedling from an un-named seedling (from *Sincerity* x *Carmel*) by pollen of *Murmansk,* was a pure icy-white green based trumpet of perfect quality; it was not large, but when it grows stronger, may develop into a fine thing. I think I selected 19 seedlings with pink tinted crowns for further trial: one, bred from *Pink O' Dawn* by *Lisbreen,* was of more or less trumpet dimensions, the trumpet being uniform pink of about the deepest tint I have yet seen.

Another terrific westerly gale during Easter weekend, April 24th to 26th, practically finished the season, though of course, the very latest small crowned Leedsii and Poets continued into May.

In spite of these gales, it was a long and memorable season providing a rich and satisfying feast of the most glorious daffodils I have ever seen for fully 7 weeks.

DAFFODIL NEWS NOTES

ARNO H. BOWERS,

Associate Chairman, Narcissus Committee

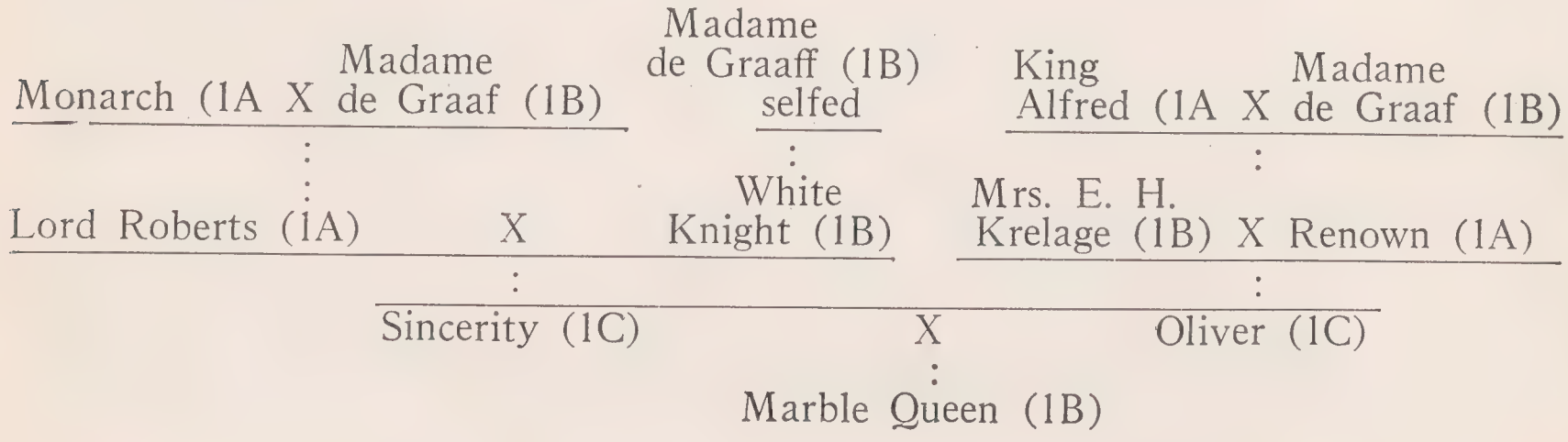
Due to disturbed world conditions, reports of daffodil shows both here and abroad are not as numerous as they have been in the past. However, it is encouraging to learn in those that have been sent to us recently that most of the English and Australian Shows are being continued—certainly a commendable effort in the face of difficulties. Entries appear to be excellent and attendance splendid.

It is interesting to note that in these shows the amateurs have come to the fore. At the Royal Horticultural Society Daffodil Show held in London, the Engleheart Cup given for 12 varieties of the exhibitor's own origination has for years gone to either Mr. J. Lionel Richardson or Mr. Guy L. Wilson, both commercial daffodil growers and breeders. Last year this most coveted trophy in the daffodil world went to an amateur, Major F. C. Stearn. Among his winning flowers were several bred from *St. Egwin* by *Crocus.*

Another amateur, Mr. W. B. Cranfield was awarded a medal for the best flower in the show—a very fine bloom of Mr. Richardson's *Goldcourt.*

At the Melbourne Show in 1943 Mr. O. Ronalds, also an amateur, won the Henry Boyce Perpetual Challenge Cup for the best lot of seedlings in the show over two excellent exhibits shown by West and Fell and H. A. Brown. One of these clones *Sweet Lass,* was awarded the distinction of being the best seedling in the show. It is described as "a very smooth, round perianthed incomparabilis of a uniform rich yellow, the perianth segments overlapping and slightly reflexing, and with a prettily formed crown of intense red right to the base."

Four other daffodils of Mr. Ronalds, all seedlings were considered to be "best in the show" in their particular divisions—yellow trumpet, white trumpet, bi-color trumpet, and incomparabilis with white perianth. The white trumpet champion, named *Marble Queen,* was bred from two bi-colors, both having the old *Madame de Graaff* in their past, *Sincerity* x *Oliver,* the later also a champion seedling of Mr. Ronalds. Those interested in pedigrees may study the heritage of *Marble Queen* given in the figure below. *Renown,* the pollen parent of *Oliver,* is a famous Australian yellow trumpet.



When one notices the recognition given to some of the breeders still classed as amateurs, one cannot help but wonder whether the classification does not detract from the very good seedlings that are developed. In the usual sense of the word, ''amateur'' means a beginner or ''one unskilled.'' Yet in the case of some of the breeders of amateur standing their names have been appearing in the award lists of shows for years. A seedling of Mr. Ronalds in 1939 was given the distinction of being the best seedling in the Canterbury and District Horticultural Society Show.

Hence, while amateur is used to distinguish the exhibitors or breeders from the commercial or professional, it would appear that some consideration should be given to another designation—some classification between amateur and professional, denoting achievement but not requiring commercial activity.

Sales of daffodil bulbs in 1944 appear to have been excellent. Quite a few growers in this country were sold out long before the end of the planting season and we learn that with the Irish breeders business was so brisk that it was impossible to fill all orders—in fact, orders had to be taken for future delivery.

It would appear that in spite of the fact that people may not have as much time to devote to the garden as previously, they are still buying bulbs to plant. In some cases—and it is an encouraging note—the increased wages have made it possible for some to purchase bulbs they have never felt able to afford previously.

My own great disappointment in not being able to obtain certain bulbs was pretty much confined to *N. minimus, cyclamineus* and *triandrus concolor.* Perhaps I waited too long to order.

Speaking of these miniatures, it is curious that many of the new and more interesting seedlings mentioned in recent correspondence are species hybrids. It would almost appear that with Mrs. Reynolds' valuable and informative article on them in this issue, there is a collusion on the part of the Narcissus Committee to emphasize this relatively undeveloped field of breeding. However, such is not the case If this coincidence has any special significance, it would appear that more interest is accruing (or can interest ''accrue'' only on money?) in the miniature hybrids.

Grant E. Mitsch of Lebanon, Oregon writes: ''Several years ago, one of my Gladiolus customers in England sent me two small bulbs of the cyclamineus hybrid, *Mite*, and I have been trying to build up a little stock of this before letting any of it go. Have endeavored to find additional stock but apparently no commercial grower either here or in the British Isles lists it and it apparently must have been all but lost to cultivation. Be that as it may, it is the prettiest and most delightful little cyclamineus hybrid that I have seen and it is fertile both ways. A few of my four year old seedlings from it bloomed this year and one from it crossed with *Malvern Gold* gave me one of the most interesting seedlings that I have seen. This flower was very much like a miniature edition of *Malvern Gold* but more perfect and formal in form and with

texture suggesting jonquil ancestry. The stem and foliage were of a yellow green color and I anticipated that it might die after blooming once. However, on digging it recently I got a nice sound double nozed bulb and I am now hoping to be able to save it. There were several other seedlings which resemble *Mite* rather closely. One lot of *Mite* crossed with pollen of the species *N. cyclamineus* gave a lot which bloomed at three years and nearly all showed close resemblance to cyclamineus in both size and form.

"Another interesting lot this year was from the Australian variety *Vera West* x *Fortune*. Three from this group were quite distinctive—light lemon yellow jonquils with three or four blooms to a stem. I usually do not emasculate the flowers I cross and do not cover them but since I am sure there were no jonquils blooming when this cross was made, and if there were, they were quite some distance from these varieties, it seems likely that the incomp. *Vera West* may contain some latent jonquil blood."

A letter from C. F. Coleman of Cranbrook, Kent, England reports further on his *Mitylene* x *N. cyclamineus* cross, previously reported in his article "Miniature Hybrids" in the 1940 R. H. S. Daffodil Year-Book. He had stated in the article that of the thirty seedlings that had flowered, 90 per cent showed the reflexing habit of *N. cyclamineus,* and that in color the seedlings were about equally divided between gold selfs or gold trumpets with lighter perianths and white selfs or fading to white. The height averaged about ten to twelve inches with the foliage resembling the glossy green of the pollen parent. The later report states that of the 45 flowering from 59 seeds, approximately 56% are whites or pale bicolors that go off white, 13% are true bicolors, and about 31% are gold selfs. So, white is dominant in this combination with the form predominantly cyclamineus.

Some of these cyclamineus hybrids are fertile and are being used in further crossing. Another cyclamineus hybrid, *Pepys,* bred by P. D. Williams, is fertile, as is *Le Beau* reported to be, in addition to Mitsch's almost-lost *Mite.* However, these are rather rarely found in this country. Were it not for the widespread misinformation that *February Gold* is sterile, it is likely that it would have been used much more in breeding since it is the most widely grown of the cyclamineus hybrids in the United States. Certainly it isn't sterile in southern California although no one could call it a generous seedbearer—ten seeds per pod being very good production (with Fortune pollen), two to five seeds being the usual range, 25% to 70% of which may not germinate. At least, that is my experience.

From this I judged that *Orange Glory,* listed as a cyclamineus hybrid, would give but few seeds. That conclusion was pleasingly erroneous as it proved to be as good a seeder as the average large daffodil. Since species hybrids are considered to be sterile or nearly so, doubt arose as to whether it was a primary hybrid until I read in the 1920 Midland Daffodil Society Report where Mr. Guy Wilson stated that he heard *N. cyclamineus* was the grandfather of *Orange Glory.*

Most of its progeny therefore will probably not be miniature but some interesting forms should appear.

An English breeder writes that he is putting *N. cyclamineus* on *Beryl (poeticus* x *cyclamineus)* to test the Mendelian theory as to whether the hybrid and pure cyclamineus will result in equal numbers. Along these same lines, I wonder if the use of *N. cyclamineus* on some of the cyclamineus hybrids might not give more vigorous *N. cyclamineus* as a result—"*cyclamineus*" which may show a greater desire to live from year to year under ordinary garden conditions. At least, it sounds like worth while experiment even if genetically it may or may not be significant.

Red-cupped cyclamineus hybrids are probably not impossible—at least, none have been reported as yet. However, red-cupped Jonquil hybrids have been mentioned but apparently none are in commerce. It is particularly interesting to hear the following from Edwin C. Powell, Rockville, Maryland:

"Two red-cupped jonquil hybrids that appeared in the 1940 bed of seedlings gave me the greatest thrill of the past season. One was from *Trevisky,* a red and yellow incomparabilis, and the other from *Tredore* a red and yellow Barrii, by *Jonquilla.* Although I have used *Jonquilla* pollen on more than 80 varieties and produced more than 500 seedlings, these are the first ones to have red cups. They were of good size for first-year flowers, of excellent form having broad flat perianth segments of good substance, and small globular orange-red cups. Both were tall upright flowers on strong stiff stems.

"*Tredore* and *Trevisky* were raised by the late P. D. Williams, the former being introduced in 1928 and the latter in 1930. *Tredore* was rated as 'one of the best red and yellow Barriis' and Trevisky as 'one of the finest and most brilliant flowers' bred by that peerless breeder."

Two very good articles on daffodil breeding appeared in American gardening journals during 1944. In "The Flower Grower" for April, Jan de Graaff discussed breeding for pink daffodils, listing possible parents and telling how crossing should be done. Edwin C. Powell wrote on "Raise your Own Daffodils" in the September issue of "Gardener's Chronicle of America". Both articles encourage more gardeners and daffodil lovers to take up daffodil hybridizing if only on a small scale.

This is excellent not only from the standpoint of publicity but it should result in interesting more people in cossing this most widely-grown group of the Amaryllids. It fits in nicely with a part of the program of the Narcissus Committee to encourage more extensive breeding of daffodils as in this way better daffodils can probably be developed faster for the many and varied climates and soils of this country. To give the beginner helpful information as to which are good parents and what may be expected if certain varieties are crossed, Mr. Sydney Mitchell was asked to write the article which is published in this issue of PLANT LIFE. Drawn from many years of daffodil breeding, Mr. Mitchell's excellent article will be of interest not only to beginners.

Since practically every serious breeder of daffodils harvests more seeds every year than he can plant and grow to maturity, it is hoped that the Narcissus Committee can distribute seeds upon request this year to members of the American Amaryllis Society. It is urged that requests be made before August first and that requests state approximately the number of seeds the member can plant and grow on. While no assurance can be given now that crosses of trumpets, incomparabilis, Leedsiis, miniatures or any other divisions will be available as such, those requesting seed should state a preference. The Committee will try to oblige but can make no promise. Requests should be sent to the Associate Chairman of the Committee, 1708 Oak Grove Avenue, San Marino 5, California.

A report from the Narcissus Committee cannot be made at this time as the difficulty and extremely busy times have greatly delayed an adequate organization of activities.

DAFFODIL BREEDING FOR AMATEURS

SYDNEY B. MITCHELL, *California*

The urge for improvement is strong in America—we even want to improve ourselves—and in the case of the amateur it is in what we love most that we desire to achieve perfection, as instance the efforts of wives to improve their husbands. It is therefore quite natural that those who love daffodils most should want to improve them, first of all by growing them to perfection, then, by breeding, to try to get even better flowers to grow as well as possible.

These notes by an amateur are for amateurs. The objectives of the professional or commercial breeder are the ultimate breeding of a few very distinct flowers. He wants a good clean bulb which is resistant to disease and increases well, a bulb which does well under many conditions and climates and produces a pretty uniformly good flower of clear color, large size, on good stiff stems, with such substance that it keeps well. In a market flower, that it is very early or very late may be its chief recommendation. The commercial breeder may have to spend half a lifetime to get what he wants. Frank Reinelt estimates it may take four generations, that is about 20 years, to get the flowers he has in mind. This kind of breeder is not much interested in what he gets along the way, except as parents for his ultimate flowers.

The amateur's attitude is different. He may merely, as I once did, raise many seedlings because he has more time than money, and if he starts with good parents he will get from seed hundreds or thousands of bulbs, many of them of almost as great beauty as costly named varieties, with the added satisfaction that they are his own. This pride of personal product is quite legitimate and undoubtedly with many is a considerable part of the pleasure derived from long extended and sometimes discouraging efforts. Commoner, however, is the feeling of the amateur that he would just like to see what improvement, or even variation, he can get in the flower of his choice. His concern is less with ultimate perfection—he often thinks he has achieved it anyway—and he doesn't have to wait 20 years or to get something which will be grown everywhere or sold to anyone. He craves variation in size, form, color, season of bloom, anything which gives distinction, and these he can get even in the first generation. He has his fun along the way rather than on arriving. His objectives may often change from, in the case of daffodils, trying one year for trumpets large enough for the angel Gabriel, next year to ones which could only be blown by fairies inhabiting little rock gardens. There is of course no reason why the amateur should not take himself quite seriously and aim at real improvement of his favorite flower, particularly in the development of daffodils better adapted to his climatic conditions than those in commerce, often bred where winters are wetter and summers shorter than his own. He may possibly raise something of commercial value—many of the best daffodils were raised by British amateurs—but he should work without hope of such profit, getting his reward "in the joy of the working."

For the maximum in results he needs time, patience, room to grow his seedlings for five years, records to show the results of his crosses, and a good breeding stud, named varieties for parents which seem likely to give good seedlings from the experience of others. A study of the parentage of good named varieties will greatly help, and the experience of earlier breeders, especially those working under similar conditions, should be of value. It is this last which alone justifies these notes. For whatever value they may have to the amateur I shall relate my results from breeding with named varieties and then describe the methods used here in crossing and in raising the seedlings. Our garden is in the Berkeley Hills, just about a thousand feet above San Francisco Bay. It faces east, sloping down towards Wildcat Canyon, so it is well drained. The soil is a heavy black loam underlaid by clay, rich but too tight a soil for daffodils, as it seems to favor basal rot. We average about 25 inches annual rainfall, all of it between October and May. Winter temperatures rarely go below 26° F. Summers are long, cool, foggy and rainless. Our season is long and, for California, late—from the end of February to the beginning of April.

The first seeds I sowed, about 15 years ago, were from self set *King Alfred.* All the seedlings were yellow trumpets very like *King Alfred,* but two or three were of better form, that is with wider, flatter perianths. From my limited experience of sowing self sets, I believe daffodils when they set seed themselves, rather rarely here, are fertilized by their own pollen rather than from some other flower, so variation tends to be limited unless the parents themselves came from wide crosses. It is certainly more interesting, more fun, to make your own crosses. Beginning with yellow trumpets, I find I have made almost no crosses with other yellow trumpets. Minor improvements of existing varieties have always interested me less than the possibilities of bigger breaks. I have therefore used *King Alfred, King of May, Dawson City,* and *Magnificence* either with white trumpets or yellow incomps, in either case getting good seedlings. *King of May* X *Beersheba* and *King of May* X *Naxos* both gave me good very pale bicolor trumpets which finish pure white. So did *Beersheba* X *King Alfred.* White seems dominant in such crosses, and the progeny, even if lacking smoothness and perfection, are far more permanent in my garden than the big British whites, which all die out after a few years. I would now be inclined to try similar crosses with *Mortlake* as the yellow trumpet parent, it is so husky here. *Dawson City X Tenedos* gave one or two fine bicolor incomps, and from *Dawson City X Fortune* I got several good red cup incomps. *Magnificence* X *Fortune* also gave yellow incomps with deeper gold cups. If I were now working for better yellow trumpets I should use *Principal* and *Royalist* for their fine finish. With bicolor trumpets I have had little experience. I prefer those with paler rather than deeper yellow cups, and you get them in crossing yellow and white trumpets. I hope in 1945 to see seedlings flower from the pale bicolor trumpet *Trostan,* a rather poor grower here, and from *Content,* but I cannot yet report on them. Pure white trumpets do poorly here. *Beersheba* gave its huge, long-nosed flowers for a few years and then passed on. Its stems were disproportionately short here, but in a colder garden at the foot of Mount

Diablo it is taller and stronger. Both as a seed parent and from its pollen on strong yellow trumpets one can get more vigorous whites for our conditions. Its trumpet is so long it might very well be crossed with big yellow or bicolor incomps or with giant Leedsiis like *Tenedos* and still produce whites of shorter but better proportioned trumpets.

Far more of my crosses have been in the yellow, yellow and red, and yellow and white incomps and the giant Leedsiis, which are practically indistinguishable from bicolor incomps. I have as yet no seedlings from *Crocus, Trenoon* and *St. Issey* nor from the underestimated *Faithful,* all outstanding pure yellows, but *Golden Pedestal* has proven an excellent seed parent, carrying on its tall stem, good neck and early flowering. From *Golden Pedestal* X *Tunis* I selected two of my best seedlings, one a white and yellow bicolor very like *Brunswick* and the other a self yellow far superior to its seed parent; both of these I have used in later crosses due to flower in 1945. *Lucinius* and *Osiris* bred with red cups both gave nice but not distinguished flowers, and so did *Havelock,* this last particularly good with *Fortune. Pilgrimage* X *Tenedos* gave a large batch of nice seedlings I still grow for garden effect—whites, bicolors and yellows, mostly with the somewhat fluted petals of *Pilgrimage,* all of great vigor. Among them is one little jonquil-like flower, apparently a throwback to a jonquil in the parentage of *Pilgrimage.* Of the yellows with red or partly red cups I have flowered most seedlings from *Fortune.* Few of them have met my hopes; however most of them had deeper cups than *Fortune* and a little better form, and they carried on its earliness, vigor and tall stems. From *Killigrew* X *Fortune* I got several nice red cups with better stems than *Killigrew,* which has a weak neck, but *Fortune* X *Tregoose* threw a better lot, a bit rough, but colorful and very vigorous. From the best of these crossed by *Carbineer* I now have large batches of seedlings to flower next spring and the few which bloomed last spring at three years of age showed how good a parent was *Carbineer* for yellows with red cups and nice flat round perianths. I am not over fond of *Porthilly* and I imagine the cross between it and *Carbineer* has been made by many. The few I flowered did not persuade me to repeat the cross. *Rustom Pasha* has been too weak to use much here, but *Diolite* is a grand tall vigorous thing and ought to be a good parent with varieties with stronger red cups and rounder, broader petals, as it is somewhat like St. Egwin in form as well as in vigor and height.

With bicolor incomps my breeding has been quite limited and some of it so recent I can as yet report no results. It is of course obvious that for early flowers in red and white it is worth trying the Australian *Jean Hood,* which, though by no means a perfect flower, lacking something both in cleanness and form, its first early season here, its very tall stems and its great vigor, all exceptional in whites and reds, commend it for use in trying for better flowers in clearer contrast. *Polindra* too, doubtless the best white and yellow incomp, should be an excellent parent as it has every good quality. Of the older varieties in this section I have most used the now common and cheap *John Evelyn,* and, though it is not a fine flower and its seedlings are rather rough, bred with red cups it has given some lovely variations in buff, orange, apricot, red and even pink cups,

with generally inferior white perianths, gay and informal garden flowers, if that is all that is wanted. Its heavily frilled cup is often perpetuated and I believe that by breeding and selection it should be possible to get from it distinct and double cup frills. From the breeder's standpoint the giant Leedsiis are so like bicolor or pure white incomps that their use may as well be considered here. I have had more seedlings from *Tunis* than from anything else, as it sets seed so very readily and by several plantings in varying aspects I can have it in flower from very early to midseason. Its tall strong stem and its vigor commend it as a parent in spite of a rather wavy perianth and the length of time it takes for its yellow cup to pale to white and develop its bronzy rim. The latter may limit its use as a commercial cut flower, but it seems to predispose it to variation and to throw cups of pastel colors when the pollen of *Rewa* and other orange and red cups is used. My records show pleasant garden flowers from crosses on it of *John Evelyn, Treskerby, Corregio, Killigrew, Varna* and *Aleppo.* I even got some fair pure white short trumpets from it, not surprising as *Tunis* itself may be a *King Alfred* seedling, though that cannot be proved as P. D. Williams kept no records. *Tenedos* also has been a good parent, carrying on its huge white flowers, losing its tendency to split cups, and often improving its stems by crosses with taller, stiffer stemmed varieties. A big batch of *Tenedos* X *Tunis* seedlings I flowered several years ago made a fine garden group, mostly whites and bicolors, but some with more subtly colored cups including one nice pink one I fortunately was able to use before I later lost it. I am looking forward in 1945 to seedlings from *Tenedos* crossed with a fine *Golden Pedestal* X *Tunis* bicolor seedling, with *Trostan,* and with *Content.* Some years ago I had a few bulbs of a very nice giant Leedsii from Mrs. Foote of Grand Rapids, Michigan, and though I later lost it and its seedlings, they were of such fine form, such nice clean flowers I always hoped to use it again. Now I note that *Green Island,* Richardson's outstanding and still rare and expensive variety, is from *Gracious* X *Seraglio.* Frank Reinelt reports it as stunning and he is not easily knocked over.

Of quite a different type of large Leedsii are *Mitylene, White Sentinel* and *Sea Shell,* the first two known sisters and the third certainly either an unacknowledged one or from a very similar cross of the same breeder, that is from *Beacon* and a large Leedsii seedling. The effect of *Beacon* seems to have been to give its seedlings fine finish and form and leave them very susceptible to color. Here, however, where I could not keep the weakly *Beacon* alive, these three of its progeny are also short-lived, but apparently in colder climates without our long dry summers they do well and there they are well worth trying as parents. My crosses with them were nearly all with red cupped white Barriis or Poets, though I did cross all of them with colored cupped incomps. My records show several seedlings selected from *Mitylene* X *Sunstar,* but I also kept selections from *Mitylene* X *Elspeth,* by *Prince Fushimi,* by *Damson,* by *Rewa:* from its sister *White Sentinel,* a poorer doer here, I had seedlings of fine form and color but indifferent constitution, from pollen of *Ace of Diamonds, Brightling, Folly, Rewa* and *Suda,* and on *Sea Shell*

the best results were from pollen of *Rewa* and *Treskerby*. *Nelly*, a late Leedsii which P. D. Williams particularly drew to my attention, suffers from a long neck which will be hard to breed out, but I found it gave nice big flowers bred to Barriis and I have used it for pinks not yet flowered. The only really tough and persistent flat-crowned Leedsii is *Hera*, the parent, by the way, of *Nette O'Melveny*, according to its raiser, Jan de Graaff's father. It is itself a nice white of good form and the little yellow rim to its cup can be developed into stronger color by crossing it with red edged flowers. Its drawback is a long neck, but as it is cheap and a good breeder I commend it to beginners. *Hera* X *Killigrew* gave several lovely colored cupped things and from *Hera* X *Torrid* I saved a pure white with a large nasturtium-orange cup, but it was pollen of *Sunstar* and *Crimson Braid* which gave me a whole series of small late flowers on tall stiff stems, from pure white to yellow and orange edged cups many of which I still have when all comparable imported varieties have passed away.

Among the Barriis, *St. Egwin* stands alone with its great self yellow pointed flowers and very tall strong stems. Most of my early seedlings from it were disappointing because of lack of substance and I now put on it only pollen of round-petalled heavy flowers. Colonel Stern showed some outstanding progeny of it at the 1944 daffodil show in London and I understand the other parent was *Crocus*. Last season I crossed it with all the heavy yellow or white trumpets I could find and a few flat cups like *Oslo* with unusual substance. The sisters *Seraglio* and *Therapia* have been responsible for a lot of recent British introductions. Bred with *Fortune* they gave me lots of big bright flowers, more yellows with red edged cups than anything else, and often a bit rough. *Seraglio* is so much the better grower that the amateur might concentrate on it and cross it with Leedsiis and smaller, better formed flowers, working for color. *Warlock* is an excellent seeder and crossed with *Hades* I raised from it my best red and white, which I have had for some years under the garden name of *Warlord*, about as good as many British introductions and I am afraid not going to be much more permanent. Though *Hades* is listed as an incomp its use as a pollen parent is much the same as similar Barriis. It certainly gives the best red cups of anything I have used. For this purpose I would put *Sunstar* next, though I hate to pass on to later generations its poor keeping, long necked bulb. *Crimson Braid*, a very late red edged Barrii, I have already mentioned in connection with *Hera*. Its reflexed perianth sometimes persists in its seedlings, but used with any hooded variety it helps to iron out the perianth to a desirable flatness and it gives substance. I have had a few odd flowers from it with greenish edges and very much cut cups. *Mystic* gives nice seedlings but I have quit using it; its children are not adapted to our hard world. Maybe I missed a bet in rarely using Poets, but they come at the end of my season when my interest is turning to irises, and have been neglected here.

Because there is much interest in raising pink cupped or trumpeted daffodils and I had some early success in this, though I lost all my seedlings through disease, I will give some of the crosses from which I got

one or more pinks. *Sea Shell* X *Rewa* gave the largest number and the pinkest cup; *Tenedos* X *Tunis,* the biggest and strongest pink cup; *Tunis* X *Teskerby, Riva* X *Rewa, Suda* X *Rosary, Lovenest* X *Mrs. Backhouse, White Sentinel* X *Mrs. Backhouse, White Sentinel* X *Suda,* and *John Evelyn* X *Therapia* (believe it or not) gave pinks. *Mrs. Backhouse,* which never sets seed here, transmits its poor perianth. My late pink crosses with these seedlings, with a lot of Tasmanian pinks and with *Carnlough, Pinken* and *Trousseau,* of which I was given pollen, are still to come.

For no apparent reason—for I love them—I have made no crosses with Jonquils or any other little species excepting *Narcissus triandrus calathinus.* From time to time I buy a bulb or two of this very late and lovely little thing, and as long as I keep it I use its potent pollen on all the late flowers in the garden. From pollen of trumpets like *White Emperor* and *Halfa* on it I still have lemon yellow, white, and bicolor trumpets, and from pollen of *Kingdom* and *Phyllida,* old timers, I still grow their dainty and with me quite permanent progeny, of clustered cupped flowers mostly in clean whites, though there are a few pale bicolors like miniature Leedsiis.

The practices of breeding, seed sowing and bulb raising I follow are the usual ones. I shall therefore discuss these briefly. I find here that it is hardly worth while crossing in rainy or even dull foggy weather; no seed sets. I deantherize soon after the flower opens if I can. It seems essential to do this before the pollen comes up in flat flowers like Barriis and Poets where the anthers are right around or above the stigma, but where the latter is lifted above them the chances of self pollination are so reduced I am less particular. I keep the anthers I want to use in little cellophane or paper envelopes in a screw-top jar on the bottom of which I have put half an inch of calcium chloride, a dessicator which keeps the pollen usable for the whole daffodil season. I don't use brushes, but tweezers to put the pollen on the stigma, and I mark each cross with a sales label, procurable in stationery stores. Seed is collected before the pods split and is sown in fall when I can get to it. I use wire bottomed, board edged beds about 8 inches deep, sowing the seeds about an inch deep and an inch apart. I keep the seedlings in these beds two years, prolonging the growing season as long as possible by late flooding. The bulbs are about the size and shape of peanuts when they are moved into the open ground in August while they are dormant, and when well grown I find we get an odd flower or two in the third year, a good sampling in the fourth, and most of the rest in the fifth year, though some weaklings never bloom. It seems a long time, especially if you are young, to wait for the first flowering. After that there is always a batch coming into bloom each year and they become of even greater interest than the novelties, you may buy, indeed you find your buying is likely to be limited to what you think are promising parents.

DAFFODIL CROSSES CLOSE TO THE SPECIES

Mrs. Kenyon L. Reynolds, *California*

Recently, during a few days of enforced inactivity, I reread some of the old Royal Horticultural Society Daffodil Year Books and was charmed again by Mr. Alec Grey's "Notes on Dwarf Daffodils." How really delightful the small species are and how they reward the hybridist for a little effort in their direction!

I shall never forget our delighted surprise upon blooming a chance cyclamineus cross early in our hybridizing career. The cross was *Sirdar* x *N. cyclamineus.* I think we used cyclamineus pollen because we had nothing else suitable at the moment, not from any hope of a good result, and we were rewarded by a whole range of diminutive hybrids, nearly all charming and desirable. From that beginning, we have made other crosses with the dwarfs which have pleased us very much and I always intend to make a great many more and then forget to do it in the fever of excitement that the Daffodil season never fails to arouse.

But this time I am determined not to be led astray. I shall keep before my mind's eye those two charmers of Dr. Stillman Berry, *Golden Chimes (Jonquilla simplex* x *N. cyclamineus)* and *Dancing Fairy (triandrus albus* x *Bernardino).* It would be hard to imagine more delightful flowers. In the case of *Dancing Fairy* it is interesting to note that the species is the seed parent. This is much more tedious "crossing" as the small flowers are harder to work with and often have to be torn apart to deanther in time to prevent self-pollination. However, any amount of trouble is to be endured to obtain such satisfactory results.

We are confronted with one difficulty in Pasadena. It seems hard to keep *N. cyclamineus* or any of the triandrus species happy in this hot, dry climate. We have raised them from seed, but even so, have lost them later; so it is necessary to keep replenishing the stock and often I do not have the species for seed parents. However, one can always use hybrids both ways.

Our very first cross with a cyclamineus hybrid was *February Gold* x *Fortune* which gave us two unusually good flowers, one about the size of *February Gold* with a colored cup and one slightly larger, but with no orange in the cup. These two have been used repeatedly in various combinations since then and last year we bloomed some charming small things from them.

Perhaps the best was from a cross with *Pentreath,* a medium sized red-and-yellow. *Pentreath* is a flower of P. D. Williams' raising so the parents are not known, but one wonders at the delightful midget resulting from the use of its pollen on our *February Gold* x *Fortune* cross. This enchanting thing has a deep yellow, overlapping, reflexed perianth and a blazing red sun-proof cup; a most satisfactory saucy result if it continues to stay small.

One of our most refined miniatures was from *Cicely* x *cyclamineus.* It was a pure white very small trumpet. *La Vestale* x *cyclamineus* gave a series of pale bicolor trumpets which aged cream color throughout. They are very nice indeed and they seem to be strong growing as are

the *Sirdar* x *cyclamineus* hybrids. *Penvose* x *cyclamineus* gave a very long trumpet with a nice "melony" tone. A red-and-yellow seedling *(Market Merry* x *Trevisky)* x *cyclamineus* gave a nice range of orange cups varying in length, with the typical reflexed perianth. These are all small and very desirable. From *Aerolite* x *cyclamineus* there are nice all yellow forms, some light and some dark. *Beryl,* that appealing hybrid of P. D. Williams, reputed to be *cyclamineus* x *poeticus,* has given us seedlings when used as a seed parent, but so far, we have had nothing as charming as the parent.

We have been quite successful getting seeds on the jonquil hybrid *Lady Hillingdon.* In Daffodil literature *Hesla* is given as the surest jonquil hybrid to set seed, but evidently Pasadena is exactly right for *Lady Hillingdon* and we have had seeds on it by such things as *Ballarat, Bodilly, Brunswick, Cornish Fire, Ellen Ney, Fortune, Killigrew, Niphetos, Penvose, Rewa, St. Egwin, Seabank* and *Trenoon.* These have given some very nice flowers and a few may have a future value, but they are not small. The only small one is *Lady Hillingdon* x *cyclamineus.* We got one seed and bloomed a most delightful very deep yellow jumbo cyclamineus. It charmed everyone who saw it and we promptly named it *Jack-be-Quick.* Unfortunately, it has not a satisfactory constitution so far. We must repeat that cross.

Another exciting cross that gave us only one seed in 1937 still has us eagerly awaiting a bloom. It is *cyclamineus* x *Paper White.* This year we cleared the seedling bed containing it and it is a nice two-nose bulb resembling *Paper White* bulbs but smaller. Also the foliage resembles *Paper White* so it must be a true cross. It could be wonderful and, of course, the true hybridist is sure it will be—until it blooms at last.

I feel we should try to do more with *Paper White* here in Southern California where it grows so easily. Years ago we made a few crosses, but forgot them for the more spectacular members of the Daffodil group. We still have a few plants of the first cross which was *Sunrise* x *Paper White.* There were some rather nice flowers in that lot—three and four small flowers on a stem with a good thick substance, but the stem was too heavy for the cluster and as the first hybrid from a species is usually sterile or nearly so, we allowed ourselves to be discouraged after a few attempts to use it in further crosses. Perhaps when times are normal again and we have more leisure, we will work again on these and the *Lady Hillingdon* seedlings as they might produce new strains particularly suited to our climate.

TAZETTA HYBRIDS

L. S. Hannibal, *California*

In checking over various Daffodil parentage records one can find an amazing number of crosses involving all *Narcissus* types. The ease with which most forms interbreed is evident by the number of times representative forms appear in the listings. Recently a casual search for Tazetta

parents revealed that very few had ever been used, and that the crosses were limited essentially to *Tazetta* on *Poeticus,* or *Triandrus.* Only one or two questionable crosses involving trumpet Daffodils could be found. This was a bit disconcerting since the writer has long been interested in making Tazetta crosses, and in most cases where such were tried no apparent seed would develop. The basis of the trouble may be attributed to chromosome incompatibility.

The Tazettas according to Dr. Fernandes have a paired chromosome number of 20, 21, or 22, whereas the Triandrus, Poeticus, and Trumpets are usually 14. From the hybridizers experience with various plants it is often possible to cross two related species with different chromosome numbers provided the pollen parent has the higher number; for some technical reasons the reverse cross is not possible. Thus on a theoretical basis the Tazettas with a number of 20 or 22 should cross with other *Narcissus* having a number of 14, provided certain involved chromosome irregularities do not exist. Unfortunately with the Tazettas such a condition seems highly prevalent. The forms with a 2n = 21 complement can promptly be discounted as self sterile, but seemingly many of the other garden forms are too. Viable pollen has never been obtained here from the following: *N. t. chinensis (Sacred Chinese Lily), Scilly White, White Pearl, Compressa, Grand Primo, Soleil d'Or,* and a form of *italicus.*

Some of our readers may justly criticize this list as several of the clones have been reported in the parentage list and seemingly have had viable pollen. This is not impossible, but under the varying weather conditions of California it should be possible sooner or later to have ideal conditions for viable pollen. To date such has not been obtained. Out of thousands of bloom nary a seed has ever developed. Poor weather conditions? Hardly! The *papyraceus (Paper White Grandiflorus)* always sets seed, and so does the dwarf *canaliculatus* when the weather is clear. Both have very potent pollen for breeding purposes. It is just chromosome incompatability.

The tazetta hybrids are not many; the Poetaz forms are the best known and these owe their origin to the firm of Messrs. R. Van der Schoot who made extensive crosses in 1885. The hybrid *Elvira,* still popular today, came from this first crossing, and a score of others have followed. As far as known the Poetaz are all sterile, including the wild hybrids, *N. biflorus, N. Trewianus (Bozzlemen Major,* or *Orientalis)* and *N. cypri* being examples.

The *Tridymus* or *triandrus* hybrids are next best known, with *Silver Chimes* as the finest example. The latter is a cross of *Grand Monarque* on *Triandrus calathinus* (The parentage in the 1936 Daffodil Year Book seems in error) and probably no finer hybrid exists. Similar crosses using other Tazettas on *Triandrus* have been recorded. The work of Dr. Pope mentioned below shows how easily this combination can be effected.

The species *N. intermedius* is a cross of *Tazetta* on *Jonquilla,* and we are not surprised to find several similar horticultural hybrids in circulation.

Several crosses of Tazetta on "Incomps" and Trumpets have been

listed, but these crosses so far have been very inconsistent and we have not been able to repeat them with satisfactory results.

To give a practical insight into the problems of working with Tazettas Dr. Pope has kindly furnished his notes for examination and they promptly bear out all we say regarding the chromosome influence in Tazetta breeding. In 1937 he held a number of "Paper Whites" back in the ice box and had the impudence to make several score of crosses with other potted bulbs as they came into flower. These crosses were made in the house where neither rain, insects or irregular humidity could contaminate the tests. As an added precaution he deanthered all bloom, performing what he called a laparectomy on both the Triandrus and Tazetta to remove the three anthers down in the throat of the flower. The following table gives the number of seed and plants produced.

Cross	*Seed produced*	*Plants developed*
Paper White on *Triandrus alba*	300	200
T. alba on *Paper White*	150	No germination
T. calathinus on *Paper White*	—	No germination
Paper White on *T. calathinus*	25	Some germination
Mme. Krelage on *Paper White*	3	No germination
T. alba on *Hera*	300	Complete germination
Paper White on *Hera*	none	

Examination of the mature plants in 1944 while in flower verified the hybridity of these crosses. The *Paper White* on Triandrus dwarfed Tazetta foliage and the blossoms were very numerous, being mostly Triandrus in shape, but the odor was potently that of *Paper White.* The calathinus hybrids had much larger flowers. However in either case due to the *Paper White* parentage the bloom lacked substance and could not compare to *Silver Chimes.*

It is interesting to note that some seed formed in the *Paper White* pods, but that it failed to germinate. This seed according to the magnitude of the chromosome numbers involved should have been nonviable, and apparently it was. Sterile seed is not unusual in breeding work. Those who know the hybrid *Amaryllis* have readily produced numerous crosses, some very beautiful, when using *Amaryllis Johnsonii* as a pollen parent, but out of numerous attempts and many apparent takes never has *A. Johnsonii* produced a viable seed which would germinate for the writer, and we have never heard of a bulb having this popular old hybrid as a seed parent. The same applies to *Narcissus* seed. We do not wish to dis-discourage people from attempting to make Tazetta crosses or Hybrids, but if one understands the mechanism of the cross it may save a lot of lost effort as one will not be working entirely in the dark. There is a nice field of work to be explored using Tazettas such as *Grand Monarque,* if it can be obtained, on *Triandrus aurea* or some of the *Jonquilla.*

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in recognition of
their outstanding work
in collecting and popularizing bromels.

Mulford B. and Racine Foster

Plate 1

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ANDRE''S BROMELIAD COLLECTING IN COLOMBIA AND ECUADOR

Lyman B. Smith

When Edouard François André, botanist, horticulturist and editor, journeyed from the mouth of the Rio Magdalena in northern Colombia to Loja in southern Ecuador, he collected and studied a great variety of plants and animals, but there can be little doubt that his main interest lay with the bromeliads or members of the pineapple family. It must have been or he would never have continued to collect such difficult plants to prepare through all that grueling journey. Then after his return to France he spent many years studying his collections and produced as his one great monograph, the ''Bromeliaceae Andreanae,'' an account of the 122 species and 14 varieties which he had brought back. Of these, 91 species were described as new either here or in his earlier brief enumeration, and it should be noted that the great majority of them are still considered valid. With excusable pride he noted that Humboldt and Bonpland found only 19 new species of bromeliads over a much wider area.

André's achievement in making such a notable contribution to science can best be understood in the light of his character and training as revealed in the narrative of his journey in ''Le Tour du Monde'' and in the introduction to the volume on his *Bromeliaceae*. Since André was not given to self-analysis, one must read between the lines to see the man. There one is struck with his enthusiasm for collecting and his firmness of purpose that sees him through the difficulties and disappointments of travel under the most primitive conditions. Yet all the time he is describing his hardships, he seldom fails to see their humorous side and point it up with a dry Gallic wit.

His training he dismisses briefly except for an affectionate tribute to his friend and teacher, Edouard Morren, the leading authority on bromeliads in his day. There is not even a hint that André was a landscape architect famed the length and breadth of Europe, and the bald statement of the scope of his commission from the French government is all we have to indicate the esteem of his fellow countrymen. The fact remains that he was superlatively well prepared to take advantage of every opportunity to advance natural science.

Thus, after an introduction much too long for André's approval, we find him and his two companions one day in late November of 1875 embarking on a new but ramshackle stern-wheeler at the Magdalena river-port of Barranquilla. He paid humorous tribute to the Yankee owners and skipper, passengers, food, service and last, and doubtless most difficult, to the mosquitoes.

The ship had to stop at intervals for fuel and André seized each such opportunity to rush ashore and collect. At Isla Brava, one of these stops along the torrid lower reaches of the Magdalena, he collected his first new species of bromeliad, *Aechmea penduliflora* with its delicate nodding inflorescence. Evidently it did not make much impression on him at the time, for Isla Brava is not mentioned in his narrative. Understandably the great heat (sand up to 127° F.), the poisonous snakes and the vara santa tree with hollow branches full of vicious ants, all had greater impact at the moment.

The other species of the lower Magdalena were typical of tropical lowlands around the Caribbean: *Guzmania monostachia, Catopsis sessiliflora, Tillandsia Valenzuelana* and *recurvata,* and *Aechmea magdalenae.* It seems strange that he should be the first to discover the latter species, for it extends from Colombia to Yucatan, grows in dense impenetrable stands of great extent and has long been used by the Indians for its fiber. Possibly its resemblance to a pineapple caused earlier botanists to overlook it, or to look the other way rather than to try to collect it.

Even on the more temperate upper Magdalena, André found the elevation still too low for optimum conditions for bromeliads. At Honda, he changed from the boat to the mule train which was to be his chief conveyance henceforth, and started southeastward up the Cordillera Oriental toward Bogotá.

André was quickly adjusted to this new mode of travel and even the toboggan tactics of the mules on wet clay slopes soon failed to distract his attention from the spectacle about him. The trail rose, the temperature dropt, and soon Spanish moss, *Tillandsia usneoides,* and stunted vegetation marked the beginning of the "tierra fria" or cool upland where gaudy *Ericaceae* predominate.

At Facatativa he reached the rim of the ancient lake-bed in which Bogotá lies. There he found his first truly Andean species of bromeliad, *Tillandsia incarnata,* which covers the ground with a gray carpet flecked with the bright red of its bracts.

After a short stop in Bogotá where he made some very helpful acquaintances, he continued across the remainder of the Andean chain to Villavicencio on the western edge of the great llanos or prairie country of the Orinoco Basin. Crossing the Andes he began to pick up new bromeliads in earnest: *Tillandsia heterandra, Pitcairnia guaritermae* and *brachysperma,* and *Aechmea servitensis,* as well as a number of older species. However, in the bromeliad-poor llanos, André found only *Aechmea angustifolia,* a characteristic species of the Amazon Basin.

From Villavicencio, André retraced his steps to Bogotá, then swung off his old course toward a more southerly junction with the Rio Magdalena. At first he followed along the lazy curves of the Rio Funza where

Aechmea columaris

Plate 2

he found two more new tillandsias, then where the Funza suddenly drops off nearly five hundred feet in the great Tequendama Falls, André encountered his *Tillandsia tequendamae* with its own cascade of bright red bracts in a pendent inflorescence.

His route turned southward now to Barroblanco and Fusagasuga, whence he made a side trip to the famous Gulf or Chasm of Icononzo. A short distance from Icononzo he found a striking bromeliad which he later described as *Aechmea columnaris* (Plate 2) on account of its slender inflorescence which reaches a height of eight feet and seems to be made of hundreds of golden beads. Its leaves are blood red for two-thirds their length, making even the sterile plants extremely ornamental.

Nearby André collected what might be called the minimum bromeliad, for it had no stem, no scape, and only a single flower in the center of a tiny rosette of leaves. It was later named *Tillandsia Andreana* by Edouard Morren. André also discovered *Bromelia nidus-puellae* which has a dense mass of flowers nested in the center of the rosette.

Back at Fusagasuga he turned westward again and descended the Cordillera Oriental to the Magdalena at Guataqui, finding little of note in bromeliads as he rapidly lost altitude.

After crossing the Magdalena in a precariously balanced dugout canoe he started up the first slopes of the Cordillera Central. Beginning with a single new pitcairnia just across the river, his list was increased by another pitcairnia, a tillandsia and three guzmanias by the time he reached the crest at Quindio Pass.

On the way up, his route passed for a time through stands of beautiful wax palms with white trunks like slender columns of ivory, and at Las Cruces he came to a hacienda whose economy was based in large part on the collection of this wax. The owner of the hacienda proved both intelligent and hospitable and André stayed for a while to take advantage of the rich collecting.

On one occasion his host organized a jaguar hunt for André's special benefit. André struggled down to the bed of a ravine through dense jungle and laid in wait for the jaguar to be driven past. Unfortunately some epiphytes—among them some new tillandsias—so distracted his attention that the beast got clean by him and he caught only a glimpse of it as it flashed into the brush.

Leaving Las Cruces, André went up over the divide and struggled into Salento after nightfall. Here his *Tillandsia rariflora* proved to be rare in more than flowers, for nobody has collected it in the seventy years that have elapsed since then. Another night on the downslope he was forced to spend in a filthy hovel at Tambores, but the next day he reached Cartago in the Cauca Valley. The west slope of the Cordillera Central had netted him a new aechmea and four new tillandsias.

From Cartago, André turned sharp left and proceeded southward up the Cauca Valley. As usual, the return to the lowlands signalled the practical disappearance of interesting bromeliads. The same distance that had yielded him so many new ones in crossing the Cordillera Central, now gave him nothing new and very little old along the winding swampy Cauca.

By the time he reached Buga about seventy miles to the south of Cartago he felt there was little more to learn from the monotonous valley. So agreeing to rejoin his companions at Cali, he took one peon and started on a side trip across the Cordillera Occidental. After ferrying the Cauca, he went down its west bank over terribly muddy and often flooded roads until he reached Vijes. There he was warned that his intended route over the mountains was both difficult and dangerous, but feeling sure that the alternate route offered but poor collecting he stuck to his decision.

He was soon rewarded with some very rich collecting as his trail entered the dense humid forest of the Alto del Potrerito. There he found a great variety of cryptogams and the new bromeliads, *Guzmania sphaeroidea* and *Tillandsia Carrierei,* as well as *Tillandsia tenuispica* that he had discovered but a short time before.

As André climbed higher he came out on the rounded crests of the Cordillera with their short grass or loma formation. Then his route went down and for a time he found forest between Alto del Bitaco and the Rio Dagua. This stretch of trail drops three thousand feet in a short distance. Looking down, André remarked on the strange white pattern on the vegetation below and his guide explained that it was the bones of travelers and their mules picked clean by the vultures. In spite of the risks of such a trail, he still managed to collect a few more new bromeliads.

At Las Juntas he started back after an unpleasant night with vampire bats. His *Tillandsia fragrans* comes from this locality and further on where he entered an arid region at Los Hornos (the ovens), he came on a great bromeliad, six to nine feet high with rigid leaves like fluted zinc and great red-violet panicles. This was the *Tillandsia secunda* of Humboldt. In the small settlement of Los Hornos the houses were surrounded by very effective hedges of *Bromelia Karatas* with its long leaves armed with great sharp hooks pointing in all directions.

André rejoined his companions at Cali, rested from an attack of fever and made preparations for the next leg of his journey. This part from Cali to Popayan was uneventful.

Next he had a choice of two southward routes from Popayan to Pasto and deliberately chose the worse because so little was known of its geology. Both his expectations and his fears were justified and the party reached Pasto much the worse for fever and little richer botanically.

At Pasto, André rested and refitted for two weeks and also took some short side trips. Best of these was the one to Laguna Cocha high in the western Andes near where the great Rio Putumayo has its source. A local mountaineer offered to guide him and they set out early one day with several other natives of Pasto. Leaving their horses at an Indian village they began the hard ascent of the Cordillera del Tabano by the "monkey trail" using their hands almost as much as their feet. On every side an infinite variety of cryptogams, orchids and bromeliads covered all parts of the trees and in spite of the difficulties of the trail

André managed to collect a goodly number. *Guzmania candelabrum* hung from high branches like the chandeliers of a cathedral.

After going through a narrow defile so overgrown as to be almost a tunnel, they emerged on the Alto de la Cruz and were rewarded with a magnificent view of Laguna Cocha. A painful descent by two "ladders" of roots brought them to the edge of the lake at the hut of Casapamba, but not without losing two of the party who spent a miserable night in the woods.

The next day André set out in the driving rain to explore the lake margin. As he waded through tall sedges something like a telegraph pole suddenly loomed up before him. It was *Puya gigas,* (Plate 3) one of the largest of bromeliads with a flowering stem thirty feet high. Although André was able to cultivate it in France, it never produced flowers there.

Before leaving Pasto, André was met by Jules Thomas, a French resident of Tuquerres who had come especially to conduct him to that city. About halfway there, near the deep gorge of the Rio Guitara they encountered a beautiful puya with a graceful open panicle and pale green flowers. Years later André described it as *Puya Thomasiana* in pleasant memory of their association.

From Tuquerres, André made a short excursion to Volcan Azufral on whose lower slopes he found puyas, tillandsias, guzmanias and other plants that grow well in European cool houses. In sharp contrast to the deep green lowland was the pale grass of the upper slopes and the riot of color in the crater lake of Laguna Verde and its surrounding amphitheater.

André had heard of the rich lowland country about Barbacoas to the northeast and decided to go collecting in that direction in spite of reports of the worst roads yet. He soon passed the western crest of the Cordillera and before him lay the great alluvial outwash from the bursting of the prehistoric lake that used to occupy the upper reaches of the Patia. At San Pablo the trail became too bad for his horse and he had to proceed on foot or riding in a chair strapped back to back on his Indian porter. About the same time he entered the rainiest country he had yet seen. Heavy storms were almost continuous and the Indians built their cabins on stilts like lake-dwellers.

If the trail to Laguna Cocha merited the title of "monkey trail" this could only be described as the "bird trail." At the Rio Cuaiquer which he had to cross on a swaying bridge of lianas, André found his *Guzmania Morreniana* with its close-packed chestnut spikes and hieroglyphic leaf-markings and *Guzmania Eduardi* with its brilliant red involucre. Both commemorate his friend Edouard Morren.

At Los Astrojos at the summit of a long climb, Indians had erected a rustic cross and adorned it with an epiphytic guzmania with appropriately blood-red leaves. This was André's *Guzmania sanguinea* which became popular in cultivation.

Near another crest, Alto de Armada, he looked up to see bright red and yellow heads of flowers hanging from delicate vine-like plants of *Guzmania caricifolia* and *graminifolia.* These two species that have yet

Puya gigas

Plate 3

to be rediscovered, he placed in a new genus, *Sodiroa,* on the basis of their habit.

Just short of Barbacoas, André turned back in order to save the collections he had made. In addition to the bad trail he had his worries from close landslides and a drunken porter whose delay in returning to Tuquerres nearly ruined the last lot of specimens.

Fig. 1. André and companion sleeping among bromels; Niebli region, Ecuador.

Heading south on his last lap toward Ecuador, André traveled over a high nearly bare plateau where the only trees were an occasional alder or willow. However, the low vegetation of such genera as *Bomarea, Fuchsia, Berberis* and *Vallea* was very colorful, and many high cascades

added to the grandeur of the scene. Bromeliads were few, but he did find *Tillandsia lajensis* near the sanctuary of the Virgin of Laja and *Tillandsia rectiflora* by the natural bridge of Rumichaca which he crossed into Ecuador.

In Colombia, André had frequently been below the optimum range of bromeliads, but now in Ecuador he traveled at such an altitude that he was more often well above it. On the paramo above Tulcan, he met with his first Ecuadorean bromeliads including *Tillandsia tetrantha* var. *scarlatina* with brilliant red bracts.

By the cañon of the Rio Chota he found both extremes of bromeliad range, with the new *Puya aequatorialis* on the bleak paramo and *Tillandsia recurvata* along with sugar cane plantations on the riverbanks some 4500 feet below. The puya was another indication of the height of his route since it is a genus of the open paramo formation above tree-line while the majority of bromeliads prefers dense forest.

After reaching Quito, André did a little local collecting and then had the good fortune to meet R. P. Sodiro who knew the region in great detail. On their first expedition they went south to Corazon and then struck west down the Rio Toachi. At Tambillo near Quito, André found his *Tillandsia pastensis* for a third time. It is interesting to note how often André recollected his own new species, a situation which is eloquent of the neglect of the family by earlier collectors.

On the slopes of Corazon André found his *Puya vestita* with densely woolly sepals and *Tillandsia homostachya,* another member of the subgenus *Pseudo-Catopsis* with zig-zag spikes of tiny flowers. At one point along the river they passed through a stand of horsetails, *Equisetum giganteum,* over fifteen feet high. The return was complicated by mutinous porters but André cowed them by heroic measures and brought his collections safely back to Quito.

A second trip was north and west of the region of Niebli where André found his richest collecting in Ecuador. In the haul were three new guzmanias and a new tillandsia and according to his illustration (Fig. 1) they even slept surrounded by bromeliads.

After about a month, André left Quito and collecting a little more as he moved south he finally arrived at Babahoyo on the Rio Guayas and here his account in "Le Tour du Monde" ends. However, we know from his collections that he went to Loja before starting home.

After his return to France, his bromeliads occupied much of his time for the next thirteen years, and later botanists are grateful to André not only for the magnitude of his collecting but even more for the accuracy and fullness of his reports.

THE SUBFAMILIES AND GENERA OF THE BROMELIACEAE

Lyman B. Smith

In constructing these keys to the subfamilies (or tribes if you prefer) and genera of the *Bromeliaceae,* special reference is made to cultivated material. An asterisk is placed after any genus now known in cultivation and two after those that are really widespread.

Cultivated material has for the student the great advantage of showing the petals and stamens which are all too often lost in herbarium specimens. Consequently for live plants we can make a natural key based on characters of primary systematic value, while we are forced to construct artificial keys in order to have efficient means of identifying most dried specimens.

Following Mez and Harms, the character of the form of the pollen-grains has been retained as a basic division in the subfamily *Bromelioideae,* but correlating characters have been added so that it will be unnecessary to resort to a microscope in many cases. The character of petal-appendages breaks down very badly in the *Bromelioideae* and has had to be abandoned in large part. On the other hand the distinction between simple and compound inflorescences has been used for its great convenience although it is of secondary importance systematically.

Seeds variously appendaged (naked in *Navia,* but the ovary superior and the fruit dehiscent); ovary wholly or in part superior (wholly inferior in *Pitcairnia anomala);* fruit a capsule (but indehiscent in a few species of *Pitcairnia).*

Seeds with entire appendages, not plumose; ovary usually wholly or in part superior; leaves often spinose-serrate; plants almost always terrestrial. .....Subfamily 1. *Pitcairnioideae.*

Seeds plumose; ovary nearly or quite superior (except in *Glomeropitcairnia);* leaves always entire; plants chiefly epiphytic.
Subfamily 2. *Tillandsioideae.*

Seeds always naked; ovary wholly or in very large part *(Acanthostachys)* inferior; fruit always baccate, fleshy to coriaceous; leaves usually spinose-serrate; plants chiefly epiphytic.
Subfamily 3. *Bromelioideae.*

Subfamily 1. Pitcairnioideae.

1. Seeds appendaged; sepals convolute with the left side of each overlapping the right of the next one.
   2. Petals free; filaments not forming a tube.
      3. Flowers perfect.
         4. Ovary wholly superior.
            5. Petals naked.

6. Seeds with a wing surrounding at least three sides; usually large coarse plants.
7. Petals broad, much more conspicuous than the sepals; seed-wing little if at all produced. .....*Puya.**
7. Petals narrow, inconspicuous; seed-wing produced dorsally .....*Encholirium.**
6. Seeds caudate-appendaged at each pole.
8. Seeds or ovules merely apiculate; placentae basal. *Cottendorfia.*
8. Seeds long-caudate; placentae usually extending almost the full height of the cell. .....*Lindmania.**
5. Petals each bearing a single large scale near base.
9. Spreading shrubs; the scape with a definite cambium layer; inflorescence paniculate. .....*Deuterocohnia.**
9. Low cushion-forming plants; scape lacking; inflorescence 1-flowered, at the ends of the branches. (Including *Meziothamnus).* .....*Abromeitiella.*
4. Ovary at least partly inferior.
10. Flowers large and conspicuous, usually zygomorphic; petals often appendaged, several times as long as the ovary; ovules numerous. .....*Pitcairnia.***
10. Flowers minute, regular; petals from about twice as long as the ovary to much shorter; ovules few.
11. Filaments all free; petals elliptic, clawless. (Including *Bakeria).* Imperfectly known and possibly a synoym of some other genus.) .....*Bakerantha.*
11. Filaments of the second series connate with the petals; petals clawed or clawless. .....*Brocchinia.*
3. Flowers functionally dioecious with one sex aborted, inconspicuous, never more than 15 mm. long; ovary from wholly superior to very slightly so. .....*Hechtia.**
2. Petals joined centrally to a tube formed by the bases of the filaments but their margins free, yellow or orange; seeds winged. (Including *Prionophyllum).* .....*Dyckia.***
1. Seeds naked; sepals imbricate with both posterior ones overlapping the anterior .....*Navia.*

Subfamily 2. Tillandsioideae.

1. Ovary wholly or almost wholly superior; seeds plumose-appendaged only at base or apex.
2. Appendage of the seed basal, straight at maturity.
3. Petals free or slightly joined with the corolla-tube deeply included in the calyx.
4. Petals naked or rarely with vertical folds; inflorescence of one or more distichous-flowered spikes or rarely simple and polystichous or even 1-flowered (Including *Cipuropsis)* *Tillandsia.***
4. Petals each bearing one or two scales on the inner surface.

5. Flowers distichous or if rarely polystichous then the floral bracts forming the conspicuous element of the inflorescence; branches usually elongate when present (Including *Alcantarea*). .....*Vriesia.***

5. Flowers polystichous or the branches of the always compound inflorescence (as shown by the two series of bracts) reduced to single flowers; primary bracts always the conspicuous element of the inflorescence; branches usually aborted. (A weak genus that is increasingly difficult to separate from *Vriesia*). .....*Thecophyllum.**

3. Petals joined or closely agglutinated and simulating true fusion, the corolla-tube about equaling the calyx; flowers always polystichous.

6. Petals naked. (Including *Caraguata, Schlumbergera, Sodiroa, Massangea*). .....*Guzmania.***

6. Petals bearing two scales on the inner surface. *Mezobromelia.*

2. Appendage of the seed apical, folded over at maturity; sepals strongly asymmetric in most species; flowers polystichous. *Catopsis.**

1. Ovary only half superior; seeds plumose-appendaged at both ends. *Glomeropitcairnia.**

Subfamily 3. Bromelioideae.

1. Pollen-grains smooth; scapeless plants or else (*Bromelia* subgenus *Eubromelia*) the petals centrally connate to a filament-tube.

2. Petals free, appendaged on the inside.

3. Filaments of the second series free; petals clawless, fleshy. *Fascicularia.**

3. Filaments of the second series connate with the petals; petals clawed, thin.

4. Inflorescence compound; several flowers in the axil of each large bract. .....*Sincoraea.*

4. Inflorescence simple; a single flower in the axil of each bract. *Cryptanthopsis.**

2. Petals connate toward base, naked.

5. Petals joined by their margins.

6. Inflorescence simple; sepals nearly or quite free; petals fleshy, erect. .....*Greigia.*

6. Inflorescence compound with several flowers in the axil of each foliaceous bract; sepals joined for much of their length; petals thin, white, their lobes spreading. .....*Cryptanthus.***

5. Petals centrally joined to a filament-tube but their margins free.

7. Inflorescence compound. (Including *Karatas*). *Bromelia.***

7. Inflorescence simple, few-flowered .....*Deinacanthon.*

1. Pollen-grains variously sculptured or marked (smooth, irregular and probably aborted in *Aechmea magdalenae*).

8. Pollen-grains with 2, 4 or numerous protruding pores; sepals usually asymmetric and strongly mucronate or aristate.

9. Stems dimorphic, the flowering stems scaly and leafless, the vegetative with rosettes of fully developed leaves. .....*Disteganthus.*
9. Stems all alike.
10. Inflorescence involucrate with leaves or colored bracts surrounding it, dense.
11. Petals naked, usually much connate; sepals usually somewhat connate.
12. Flowers sessile; petal-blades erect and cucullate in most species. .....*Nidularium.***
12. Flowers slenderly pedicellate; petal-blades spreading, acute. (Including *Aregelia*). .....*Neoregelia.***
11. Petals appendaged.
13. Petals free.
14. Sepals free .....*Canistrum.***
14. Sepals connate .....*Aechmea* subgenus *Ortgiesia.**
13. Petals connate; scape-bracts and primary bracts foliaceous. .....*Wittrockia.**
10. Inflorescence not involucrate.
15. Filaments bearing 2 large auricles which overtop the anthers .....*Androlepis.**
15. Filaments not appendaged.
16. Inflorescence compound.
17. Scape-bracts large and foliaceous.
18. Leaves subentire, grass-like; epigynous tube large. *Andrea.*
18. Leaves spinose-serrate; epigynous tube very short or none.
19. Sepals nearly or quite symmetric. *Orthophytum.**
19. Sepals asymmetric; inflorescence densely digitate with reflexed bracts. .....*Aechmea magdalenae.*
17. Scape-bracts distinctly different from the leaves.
20. Flowers strobilate, strongly compressed.
21. Epigynous tube none or minute; pollen grains with 2 or 4 pores; petals naked or appendaged. *Hohenbergia.**
21. Epigynous tube well developed; pollen-grains with numerous pores; petals appendaged. *Gravisia.**
20. Flowers not strobilate nor compressed.
22. Flowers slenderly pedicellate; sepals mucronate.
23. Petals naked; sepals connate; flowers minute. *Araeococcus.*
23. Petals appendaged.
24. Pollen-grains with 2 pores; sepals free. *Aechmea* subgenus *Podaechmea.***
24. Pollen-grains with numerous pores; sepals connate .....*Portea.**
22. Flowers sessile or if pedicellate then the sepals unarmed.

25. Ovules not more than 10 in each cell; flowers minute; sepals unarmed; petals naked.
*Araeococcus.**

25. Ovules numerous in each cell.
26. Petals naked. (Including *Pironneava).*
*Streptocalyx.**

26. Petals appendaged, sometimes obscurely.
27. Sepals mucronate or aristate or if entire then the ovules long-caudate. (Including *Wittmackia).* .....*Aechmea.***

27. Sepals unarmed; ovules obtuse; inflorescence very little branched when compound.
*Quesnelia.***

16. Inflorescence simple.
28. Ovaries always remaining distinct.
29. Ovary slightly superior, its apex rounded and protruding above the insertion of the perianth; scape slender, naked except at apex; inflorescence small, strobilate .....*Acanthostachys.***

29. Ovary wholly inferior.
30. Ovules obtuse; petals naked; inflorescence lax.
Ronnbergia.

30. Ovules caudate or if obtuse then the petals appendaged; inflorescence often strobilate.
31. Sepals mucronate or aristate or if entire then the ovules long-caudate. (Including *Chevalieria)*
*Aechmea.***

31. Sepals unarmed; ovules obtuse. ....*Quesnelia.***

28. Ovaries fusing to form a compound fruit or syncarp.
32. Syncarp at maturity bearing a minute inconspicuous coma of reduced bracts, never producing slips at its base; petals bearing lateral folds. *Pseudananas.**

32. Syncarp at maturity bearing a conspicuous coma of foliaceous bracts, frequently producing slips at its base; plant not producing stolons; petals bearing infundibuliform scales .....*Ananas.***

8. Pollen-grains without pores, but with fine markings and a lateral fold on drying; sepals usually unarmed and nearly or quite symmetric (minutely mucronate and asymmetric in *Neoglaziovia).*
33. Petals naked.
34. Inflorescence capitate; scape none or almost none; stamens exserted. (Including *Rhodostachys).* *Ochagavia.*

34. Inflorescence and scape elongate; stamens included.
Fernseea.

33. Petals appendaged; scape evident.
35. Ovules few in each cell; flowers regular .....*Neoglaziovia.**

35. Ovules numerous in each cell; flowers zygomorphic.
*Billbergia.***

WHERE BROMELIADS ARE FOUND

MULFORD B. FOSTER

Without a doubt the Andean area of South America mothered the family into existence. While the puyas, the earliest members of this interesting group, have devoted their efforts toward survival in their original home area, regardless as to how high they have been pushed up into the clouds (Plate 2), their great line of descendants have migrated all over South America and the southern area of North America.

Whenever we study the migration of birds, men or animals we see a similar pattern, we find men following the plants in low swampy land, in the high mountains, in low rolling hills or on the desert.

Brazil, it seems, has been the favorite place of residence for the bromeliads, as the greatest number of different genera and species are to be found there. And yet, one could travel for days within certain areas without seeing hardly one bromeliad.

The puyas have traveled from Chile to Costa Rica, yet they have not set root in Brazil.

Tillandsia usneoides and *T. recurvata,* called Spanish Moss (Fig. 2) and Ball Moss, have been the greatest migrators of all; they now live in every country and state where there are any bromeliads to be found (with the exception of Africa.)

In marked contrast to these *Tillandsia* species that use the most modern way of travel, via air, their relative *Vriesia itatiaiae* (Plate 5) has been so self-satisfied that it lives on Mt. Itatiaya, one of Brazil's highest mountains and nowhere else on the earth. There are other endemics in the family but few with a range so limited.

The genera *Navia, Brocchinia* and *Bakerantha* are found north of the Amazon in the Guianas, Venezuela, Brazil and Colombia. They are rare and isolated in habitat.

Cryptanthopsis, Cottendorfia and *Sincoria* are limited to a small area of southwestern Bahia in Brazil.

Encholirium is coastal from below the mouth of the Amazon to Espirito Santo and inland as far as Minas Geraes and Bahia.

Ochagavias are isolated on Juan Fernandez Island off the coast of Chile.

Abromeitiellia and *Fascicularia* choose high Andean ranges of Chile to be near their ancestors.

Greigia has not left the home ground of the puyas and are to be found from Costa Rica to Chile.

Lindmania, a very early relative of the puyas has kept close to them but has also gone farther north and on into Mexico as well as around the northern rim of the Amazon basin, but it has not gone down into Chile.

Ronnbergia and *Mezobromelia,* rare genera, seem to prefer the western part of Colombia.

Deuterocohnia with its few known species is found in the central and southern area of the puyas but has gone over into the Matto Grosso of Brazil. They have shared some of the territory with *Dyckia* but the dyckias have taken in parts of Argentina, Paraguay, Bolivia, Uruguay and a great area of Brazil as far north as the Bahia area.

Fig. 2. Bromel cousins—Spanish Moss, *Tillandsia usneoides* travels entirely by air on its own; *Ananas bracteatus* is grounded, and travels with the assistance of man and beast by its appeal to their palates. Photo by Mulford B. Foster.

Hechtia, though closely related to the puyas, has apparently never trespassed into the *Puya* domain. They have chosen their territory to be in Central America from north of Costa Rica with a northern boundary line in lower Texas, Arizona and Baja California.

Pitcairnia, on the other hand, has spread from the central part of Mexico, including the West Indies and a greater part of South America with its southern limits in the Argentine, Bolivia, and a portion of Chile. *Strange as it may seem just one species has been reported in Africa.*

In very nearly the same area as the *Pitcairnias* dwell, you will find the genus *Catopsis* excepting that it avoids Chile and some parts of the lower Argentine.

Vriesia, too, which has the southern part of Mexico as its northern limit, takes in all of the *Catopsis* area and a bit more of Bolivia and Peru. However, most of the species are native to Brazil.

The circle shrinks for *Guzmania.* The northern limit is southern Mexico and the tip end of Florida. The southern limit swings around the northern part of Brazil from Bahia across to the Pacific Coast. It is interesting to note that the Florida species of *Guzmania monostachia* has taken up residence in much of that area even to Bolivia.

A much smaller inner circle, taking in Costa Rica, a part of the West Indies and the northeastern section of South America would circumvent the area occupied by *Thecophyllum.*

The few species of *Glomeropitcairnia* are found in a very limited island area of the Lesser Antilles with Trinidad as its southern limit.

Tillandsia, greatest of all migrants in the family has made a territorial line swinging around all of the species so far named and those yet to be zoned in this treatment. Its very northern limit is the southeastern tip of Virginia at the 35th parallel; its southern limit in the Argentine to the 45th parallel would be comparable to being in the neighborhood of Maine and Nova Scotia in the North.

One of Brazil's finest fiber plants *Neoglaziovia,* a monotypic genus is found only in a limited area of Bahia and states bordering its northern boundary. *Acanthostachys,* another genus with but a single member is also Brazilian but has a greater range throughout the central section of Brazil. *Disteganthus* from French Guiana, *Wittrockia* from coastal mountains in Brazil, *Araeococcus* from Costa Rica and northern South America, *Pseudananas,* the false pineapple found on the high planes of Brazil, all six of these genera, have but from one to three species to their credit.

Cryptanthus species are all central Brazilian and the four or five *Orthophytum* species are to be found in a somewhat similar area. *Andrea* species too are limited in their central Brazilian home.

With the exception of one *Neoregelia* (which is in Peru) all of the *Neoregelia, Nidularium,* and *Canistrum* are confined to Brazil.

Hohenbergia species are native to Cuba and the West Indies with ten of the species from Jamaica; they range on down through Trinidad and into Brazil. A typical species of this genus, *Hohenbergia caatingae,* is a stiff-leaved bromel that grows in great masses on the caatinga which is similar to mesquite. It will stand very severe drought (Fig. 3).

Wittmackia and *Gravisia* seem to keep to the Atlantic Coast of South America from northern Brazil up to Costa Rica and into Puerto Rico and the Lesser Antilles.

One way to obtain bromels

Ladislaus Cutak wanted Florida's largest **Tillandsia** for the Missouri Botanical Garden collection—this put Mulford Foster up a tree. Photo by Ladislaus Cutak.

Plate 4

Androlepis has a Central American residence for its few species, while *Streptocalyx* seems to be just as satisfied in Peru as in Brazil for its species may be found in the western and northern end of South America right on down to Rio and surrounding country.

Fig. 3. *Hohenbergia caatingae.* Photo by Mulford B. Foster.

Ananas, the pineapple, may be found wild in many parts of Brazil but in just how many of the other countries of South America it was originally native is open to much discussion. At any rate some of the species grow wild over quite an area.

The genus *Bromelia* covers a great area. Some of its species may be found in Mexico, the West Indies or right on through Central Amer-

Vriesia itatiaiae

A saxicolous type of bromeliad which enjoys the wide open spaces above the tree line in a "penthouse" on the "roof" of Brazil. Photo by Mulford B. Foster.

Plate 5

ica, over a great part of South America on both the Atlantic and Pacific coasts. I have found it growing wild in many American tropical countries where almost universally it has been used by the natives as a property line marker where conditions are primitive.

The beautiful *Portea* species are few in number with a range along the Atlantic coastal region in Brazil from Rio north to Bahia.

The range of the delightful *Quesnelia* species is from the Guianas to southern Brazil and they do not go inland for any great distance.

The *Chevaliera* species keep to the Brazilian coast line also.

Most of the *Billbergia* species find their home in Brazil but they are lightly sprinkled from Mexico south and well down the Atlantic coast to Argentina with a few on the Pacific to Peru.

The *Aechmea* species are greater in numbers and greater in range than almost any of the other berry-fruit bearing bromeliads; they are native from Mexico south, including the West Indies and throughout South America. Brazil, of course, has by far the greatest number of species.

They are an intriguing family, the bromeliads. They may be found perfectly at home on the side of a house or a perpendicular rock, attached to a giant cactus or a telephone wire, overhanging a waterfall or on a rainless desert.

With or without roots the species will be found, each one finding much of their food in the air carried to them by favorable air currents or rainfall dropped into their water-filled cups far up in the trees and under the trees.

The bromeliads have explored the American Tropics for centuries and have settled down in so many out-of-the-way places that inquisitive plantsmen are still seeking their whereabouts in order to know more about them.

HOW TO RECOGNIZE THE BROMELIADS

Mulford B. Foster

[Mr. Mulford B. Foster has favored the readers with 36 excellent line drawings of various bromel species. These drawings are reproduced in Plates 6, 7 and 8. These illustrations are to be consulted in connection with the following text, and will convey an idea of the very great variety of forms to be found in the Bromeliaceae.—Ed.]

One of the most interesting plant families in America is botanically known as Bromeliaceae, but is commonly known as the Pineapple Family. The fifty genera recognized in this family contain some 1600 different species, and all are native to the Americas except one *Pitcairnia* which has been found in Africa. Twenty genera are represented in North America from Panama north.

The bromeliads are mostly epiphytic (living on trees) but none of them are parasitic. Some of them, especially pitcairnias and puyas are

terrestrial while most of the dyckias, hechtias and encholiriums are saxicolous (living on rocks).

Most of the bromeliads bloom from the axis or center of the plant but the dyckias, encholiriums, hechtias and deuterocohnias nearly always bloom laterally, or from the side;[1] the inflorescence may appear in simple or compound spikes, heads, or branching panicles, or singly as in Spanish Moss.

The leaves are spirally arranged in rosettes and more than half of the species hold water in small "tanks" formed by the close fitting base of these trough shaped leaves.

Species of *Tillandsia, Vriesia, Guzmania, Thecophyllum, Catopsis,* and *Glomeropitcairnia* all have smooth-edged leaves, while all other members of the family except some *Pitcairnia* have spines on the leaf margins.

The epiphytic forms use their roots more for holding fast than for any other purpose. The terrestial forms no doubt draw mineral nutrients through their roots, but they too, like the epiphytic forms, obtain mineral nutrients from air-borne dust particles that lodge on the leaves or fall into the moisture that collects at the leaf bases and in the crown.

Bromeliads have, for the most part, an unusual ability to adapt themselves to many different conditions under which many different plants survive. They have greater adaptability for adverse or man-made conditions than most other plants could cope with.

There are few plant families that possess such a great percentage of decorative forms as do the bromeliads, regardless as to whether they are in flower or not. While the flowers vary in form and color, the inflorescence generally receives most of its radiance from the colorful bracts or fruits which often put on a "show" for six months.

Although I have more than 400 representatives of thirty-five of the fifty known genera in this family, living in my collection, the majority of them are species of only eight genera, namely, *Vriesia, Tillandsia, Aechmea, Billbergia, Neoregelia, Nidularium, Dyckia* and *Cryptanthus.*

To know a few of the outstanding characteristics should help the average plantsman determine the more common genera of bromeliads that might be found either in the wilds or in cultivated collections.

ANANAS

The pineapple is number one in the Family of bromeliads, known the world over and grown in every tropical land, and to some extent in sub-tropical regions. The genus *Ananas* (Brazilian Indian word) to which this delicious fruit belongs has several species, all native to Brazil. The commercial pineapple belongs to the species, *Ananas comosus;* it is a terrestrial plant with leaves that are spiny in most of the forms, although there is a cultivated form, (Smooth Cayenne) which rarely has any spines on the leaf edges. The vegetative pineapple top which

[1] See Lateral Inflorescences in Bromeliaceae by M. B. Foster National Horticultural Magazine Jan. 1945.

Bromel portraits—1. **Puya coerulea;** 2. **Hechtia capituligera;** 3. **Deuterocohnia Meziana;** 4. **Dyckia leptostachys;** 5. **Pitcairnia flammea;** 6. **Tillandsia bulbosa;** 7. **Tillandsia usneoides;** 8. **Tillandsia Lindeniana;** 9. **Vriesia simplex;** 10. **Vriesia Fosteriana;** 11. **Vriesia heliconoides;** 12. **Catopsis floribunda.** Drawings by Mulford B. Foster.

Plate 6

develops on the top of all pineapples is a miniature plant itself. There may also be a number of these growths at the base of the fruit, they can all be planted to form new plants. The pineapple plant also forms offshoots or "suckers" at the base as do most of the bromeliads. The fruit which forms at the top of a stout stem is a composite one and actually contains many fruits welded into one. The flowers of all the different species are a purple blue in color. The commercial varieties of *Ananas comosus* are practically seedless but the wilder species which grow in great profusion in Brazil, contain seeds. *A. bracteata* with its beautiful long lasting red fruit is also edible but much more decorative as a garden subject and much more easily grown. *A. ananasoides* var. *nana* is the dwarf of the genus. The fruit, one to two inches long atop a tall stem, is easy for your eye and nose but would be a tough subject for your teeth.

PSEUDANANAS

There are two other genera that resemble very closely the foliage of the pineapple; one is *Pseudananas* or false pineapple and the other is *Bromelia.* Only one species of *Pseudananas, P. macrodontes,* is recognized and it looks just like a pineapple without the regulation green leaf-like top. It forms new plants on long underground stolons and not at the base as in the true pineapples.

BROMELIA

The genus *Bromelia* was named for the Swedish botanist, Bromel. The foliage of this genus is pineapple-like but the fruits are not fused, each fruit is separate on a branched head. Possibly the most dramatic members of the Family as they are coming into bloom are several of the species of these bromelias, especially *B. serra.* This spiny-leaved *Bromelia* shoots forth a center of blazing red bracts surrounding a head of flowers that rise two feet high. The maroon and white flowers emerge from a wadding of "pure white cotton." This plant called "heart-of-flame" is quite beyond description. The variegated form of *Bromelia serra* is the most striking of all terrestrial bromeliads whether in flower or not (Fig. 4).

In several Central and South American countries bromelias are planted in rows on property lines by the natives, making quite effective barriers.

PUYA

The genus *Puya* is no doubt the earliest member of the entire family of bromeliads. The majority of them live high in the Andes. Some of them develop a yucca-like trunk as they continue to bloom year after year from the center of the same plant; the flower stalk may be simple or branching. Their many leaves are serrated on the margins.

The plants range in size from one to thirty feet in height. André described the flower stalks of *P. gigas* as looking like telephone poles.

Bromel portraits—13. **Thecophyllum fastuosum;** 14. **Guzmania monostachia;** 15. **Aechmea miniata** var. **discolor;** 16. **Aechmea orlandiana;** 17. **Aechmea marmorata;** 18. **Aechmea Racinae;** 19. **Billbergia leptopoda;** 20. **Billbergia pyramidalis;** 21. **Quesnelia Quesneliana;** 22. **Cryptanthus zonatus;** 23. **Cryptanthopsis navioides;** 24. **Orthophytum foliosum.** Drawings by Mulford B. Foster.

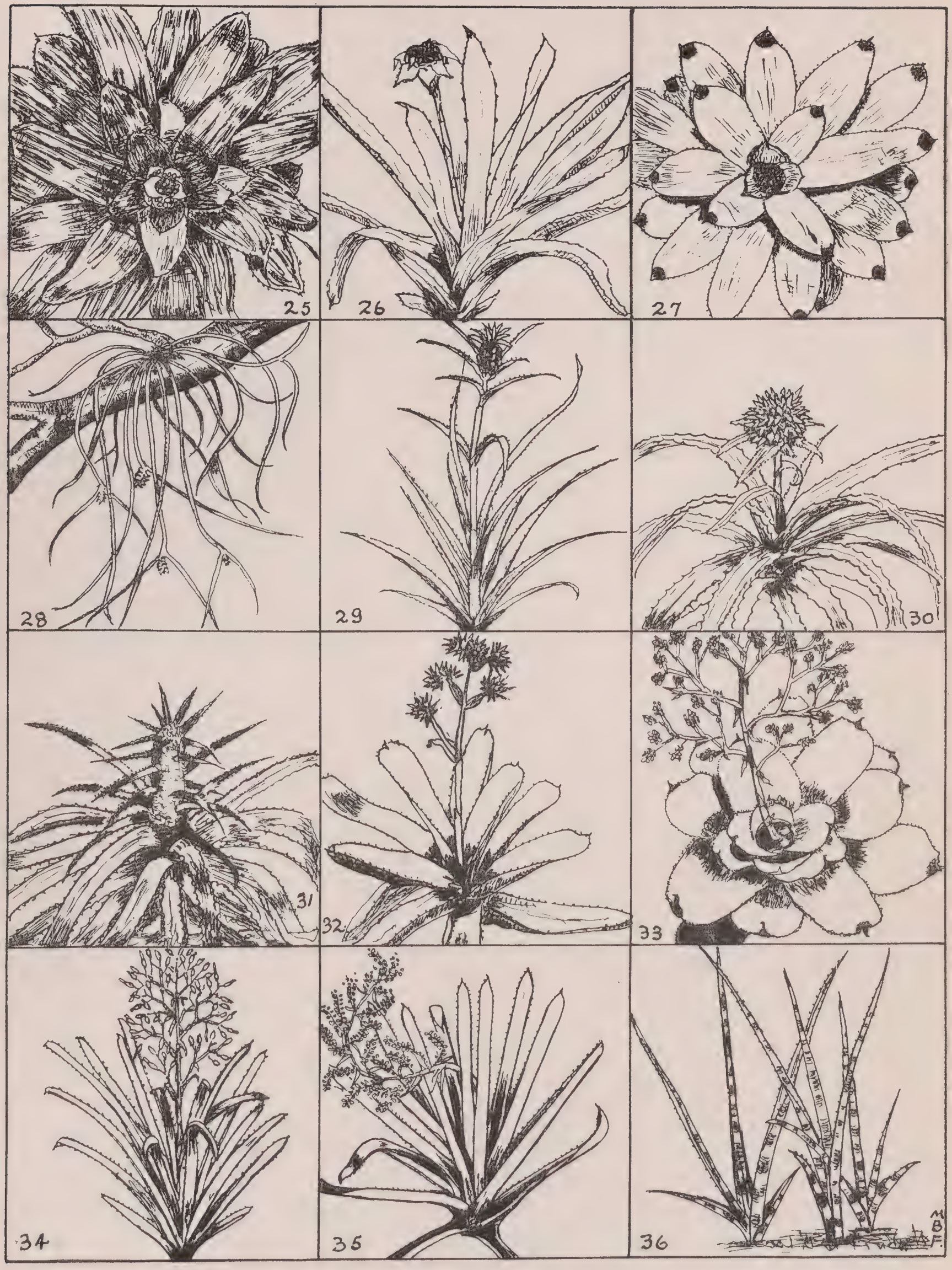
Plate 7

McBride states that *P. Raimondii* of Peru is the largest member of the entire family of bromeliads and its inflorescence attains a height of over thirty feet. Its giant flower stalks are "used for timbers in roofs." The flower colors predominate in blue-greens, greens, yellow-greens and white. Their dry seed capsules hold winged seeds. Many of the puyas can stand quite low temperatures but do not as a general rule care for low altitudes.

Fig. 4. A variegated form of *Bromelia serra.* The most striking of all the terrestrial bromeliads whether in flower or not. Photo by Mulford B. Foster.

DYCKIA

The genus *Dyckia* was named for Prince Salm-Dyck. Dyckias, the best known of the stiff succulent type of bromeliads have been used in sub-tropical rock gardens of Florida and California for several years. *D. sulphurea,* the best known and *D. rariflora* have been raised in quantities for dish gardens and succulent fans. All of the species of this genus are plants with many stiff spiny leaves in rosette form; they are all either terrestrial or saxicolous and their winged seeds mature in dry capsules; they all bloom laterally on rather tall spikes with yellow or orange flowers.



Bromel portraits—25. **Nidularium innocentii** (var.); 26. **Canistrum Cyathiforme;** 27. **Neoregelia spectabilis;** 28. **Acanthostachys strobilacea;** 29. **Ananas ananasoides** var. **nana;** 30. **Pseudananas macrodontes;** 31. **Bromelia serra;** 32. **Gravisia aquilega;** 33. **Hohenbergia Salzmannii;** 34. **Portea petropolitana** var. **extensa;** 35. **Wittmackin lingulata;** 36. **Neoglaziovia variegata.** Drawings by Mulford B. Foster.

Plate 8

Some of the dyckias, no doubt, live for fifty years or more forming a caudex or trunk which lies on the rocks like a fallen yucca; the plant always blooms from the side of this prostrate spiny rosette. *D. leptostachys,* however, sends out off-shoots from under ground stolons and a great solid mat of plants may result over a period of years.

HECHTIA

The genus *Hechtia* was named in honor of M. Hecht. Hechtias, although all species are North American, are much more numerous than dyckias, but have been generally less well known. The plants themselves somewhat resemble the dyckias although they have heavier spines and have a greater variety of color and size. Their flowers, however, are smaller and seldom as showy as those of the dyckias. They, too, like the dyckias bloom laterally or from the side with the possible exception of a new species which I discovered in Mexico eleven years ago, *H. melanocarpa.* It blooms from the center on a stem almost eight feet high. Nearly all *Hechtia* flowers are small and white and while all of the flowers are perfect, each species has two phases. One phase has the stamens fully developed and the pistil undeveloped while the other has the pistil perfectly developed but the stamens are immature and do not carry pollen. The dry capsular fruits produce winged seeds as do also the *Encholirium* species which resemble in plant form, the hechtias and dyckias.

DEUTEROCOHNIA

The genus *Deuterocohnia* is another named for Cohn. The deuterocohnias also look like the dyckias, hechtias and encholiriums so far as plant form is concerned, but their longer tubular flowers easily distinguish them from these close relatives.

One very special quality that *Deuterocohnia Meziana* has is that when the tall branched flower-stalk appears it may send forth flowers for a period of six or eight years from the same inflorescence. This shrub-like inflorescence has the rare peculiarity of having a cambium layer similar to a dicotyledonous plant and new branches and flower buds appear year after year, making it quite unique in the family.

PITCAIRNIA

The genus *Pitcairnia* was named for Dr. Pitcairn. Almost any section of the American tropics where there are rocks and waterfalls you should not be surprised to find some species of *Pitcairnia.* This group makes up a large section of the Bromeliad Family. A great number of the species would remind you of tufts of grass if it were not for their vivid red tubular-like flowers, or they may be yellow or white. The grass-like leaves are generally covered with white scales on the under side. Some of them have smooth edges while others are quite well armed with spines. Many are equipped with short, stiff, horny, barbed spines rising among the leaves from the rather bulbous base of the plants.

The pitcairnias are attractive when in flower, are nearly all terrestrial in habit and I believe, will be used much more often as garden plants

when they become better known. The branched flower spikes often continue to bloom for a period of two to three months.

TILLANDSIA

The genus *Tillandsia* was named in honor of Tillands, Swedish physician. The genus having the most numerous species in Bromeliaceae is *Tillandsia* and members of this group may be found throughout the range of the entire family. Nearly one-third of the 400 species of bromeliads in North America are tillandsias. They vary in shape and size from a few inches in height, as in *T. recurvata*, to *T. grandis* which produces a flower stalk eleven feet high.

While many of them have smooth or glaborous leaves, the more common ones are lepidote or scaly (fuzzy) like the common *Tillandsia usneoides* or Spanish Moss, none of them have spines on the leaf margins. Most of the larger smooth-leaf species of tillandsias could easily solve this confusion. The flower must be dissected and the petals examined. If petals are plain and without nectar scales attached near the base, then the plant will be a *Tillandsia*. The flowers are generally found in flattened spike formations, and are either lavender, blue, white, yellow or green. The bracts range in color from white and green to pink and red. The seeds are plumose and float through the air on little parachutes in the same manner as the seeds of common milkweed with its silken threads.

VRIESIA

The genus *Vriesia* was named for Dr. de Vriese, a Dutch botanist. The vriesias too, generally have the flattened or distichous spike of flowers but at the base of the petals will be found nectar scales. In the *Vriesia carinata* type of flower, and these are the most common in horticulture, the petals are fused or fastened together at the base but in most of the larger types such as *V. Fosteriana* the petals are separate. The predominating colors of *Vriesia* flowers are yellow, white or green and the showy bracts may be yellow, red, green or purple, often strikingly decorative for six months. Leaf margins are smooth and seeds are borne on parachutes as in tillandsias.

Vriesias must have met the fancy of bromeliad enthusiasts in Europe many years ago because there appears to have been more hybridizing done with vriesias than any other section of the family. Even today *Vriesia gloriosa*, a hybrid between *carinata* and *Barilletii*, is one of the most popular vriesias in cultivation and its striking form and long life has made it one of the most sought for bromeliads by both the collector and one who just wishes a beautiful plant for the house.

In Fig. 5, an unnamed species of *Vriesia* is illustrated. This is one of several collected by the writer.

GUZMANIA

The genus *Guzmania* was named after A. Guzman, Spanish naturalist. Guzmanias are closely related to the tillandsias and vriesias but differ in always having spikes of flowers which are polystichous or radi-

ating from all directions. The petals appear to be connected or tubular but it is really only a fairly good "glue job" and there are no nectar scales attached. Flowers predominate in yellow and white; the bracts are often brilliantly colored from yellow to orange and maroon, lasting for several months. The seeds of all three of these genera as well as *Catopsis, Thecophyllum* and *Glomeropitcairnia* are plumose and are carried through the air. They all have smooth edged leaves. Practically

Fig. 5. Unnamed *Vriesia*. One of several different beautiful Vriesias that will have to wait several years for a name; Dr. Smith thinks that it is a natural hybrid. Photo by Mulford B. Foster.

all of these closely related genera are epiphytic although some members of each genus live attached to rocks or the ground.

BILLBERGIA

The genus *Billbergia* was named in honor of Billberg, Swedish botanist. It seems that some of the first introductions in the country came here as billbergias. They were easily grown and for some unknown reason the name became fixed (in the popular mind) to most of these tubular formed plants.

Billbergias, the most commonly known bromeliads in horticulture are easily distinguished from most of the other members of the family. The leaves are generally fewer in number (from 5 to 8 leaves) than in

most other bromeliads and are with but few exceptions in tubular form; they are generally banded with grey cross bars of lepidote scales. While *B. pyramidalis* and *B. horrida* have an erect inflorescence with a rather compact head of flowers, nearly all of the species have a pendulant flower scape which is generally highly decorated with large brilliant bracts. The flowers are tubular with ends of petals curled back. The predominating colors of petals are purple, blue, yellow and green to white. The flowers are beautiful and defy description; the floral display, however, lasts only about two weeks. The bracts, from green to white and pink to red and maroon make up a greater part of the attractiveness of the inflorescence.

The fruits are ridged, berry-like and sweet to the taste. The fruits ripen more quickly than those of most bromeliads and in most cases are not especially decorative as in aechmeas, vriesias and many other genera.

Billbergias have been the fastest growing and easiest to propagate, so can be handled by the layman because of their unusual survival qualities. Such species as *Billbergia nutans* and *B. pyramidalis* are hardy and will stand considerable cold; they have enjoyed the neglect of many a Florida and California garden. While these two species are generally known as epiphytes I have found them both growing in their native habitat on rocks, or old stumps, and practically always if not on the ground, within a few feet above it. Thus they demand little attention when in cultivation. They propagate readily from seeds and the seedlings mature and flower in three years, with the exception, of course, of *B. zebrina, B. Meyeri* and *B. Porteana.*

AECHMEA

The genus *Aechmea* was named from "aechme," referring to points on the flower envelope. Of all the different genera in the bromeliad family, the aechmeas have the most varied plant forms and inflorescences. Most of the species are longer in color performance of flower and fruit and many of them put on a "show" for nearly a year. They range in size from one having a leaf spread of but a few inches to others which measure nine feet from tip to tip as in *Aechmea comifera.* This latter species has a flower head that rivals a giant pineapple. Some species may weigh but a few ounces while others will tip the scales at over a hundred pounds. Their flowering stems are generally branched and the flowers take the complete range of the spectrum for color. The bracts generally conspicuous, range in color from green to yellow and red.

The aechmeas, most of them at least, would be worthwhile decorative subjects even if they never produced their interesting spikes of flower and fruit. Their spiny edged leaves vary in form and color beyond description. The mottled leaves of *Aechmea Orlandiana* often show a color range from carbon black to pure white with splashes of red, green and purple. The flower head of orange bracts holds a cluster of yellow-white flowers and the fruit ripens to purple. *Aechmea phanerophlebia* (Plate 9) finds its habitat on ground, rocks or high on a tree limb. Its stiff leaves are edged with stout spines and it can take great punishment. It also thrives in full sun.

The aechmeas have served as a source of fiber, such as "pita" *(A. magdalena)* for centuries, as well as many forms of decorative plants in horticulture. They have a great range and are found growing natively from Mexico to Argentina, mostly epiphytic, but some are quite at home growing on the ground. Their leaves are spiny edged, generally stiff and smooth though often covered with peltate scales.

It is confusing for almost anyone to distinguish the difference between the following genera: *Nidularium, Neoregelia,* and *Canistrum.* About ten years ago Dr. Lyman B. Smith re-shuffled many of them. Some were listed under *Aregelia* and *Karatas* but these last two generic names have been thrown into synonomy, the botanical waste basket which is almost brim full with discarded names.

NEOREGELIA

The genus *Neoregelia* was named for Regel, Russian botanist. The neoregelias have their flowers in a compound head nestled in the center of a low spreading rosette of leaves, often banded, spotted or marbled, sometimes with red tips. The flowers generally blue or white barely emerge above the center water-filled "nest". Some species have large brilliant bracts that surround the flower head. The leaves, armed with spines, are generally stiff and covered with minute peltate scales.

The most commonly known *Neoregelia* is *N. spectabilis,* formerly called *Aregelia spectabilis.* The most popular name and one that will stick longer than any change in nomenclature is "Painted Fingernail Plant" because of its brilliantly painted leaf tips.

Neoregelia marmorata hybrid, a cross between *marmorata* and *spectabilis* is another one that has been known to horticulture for many years although the type species of *marmorata* seems to have disappeared. I brought this species back with me, however, from southern Brazil in 1939.

NIDULARIUM

The genus *Nidularium* was named from "nidus", referring to the nest form of leaves. The nidulariums have their flowers nestled in a similar position but the head is made up of several sections. Each section consists of a showy colorful bract holding possibly a dozen flowers ranging from red, white and blue. In most of the species the flowers do not open even though in full bloom. Their leaves are often colorful and may be striped or spotted. Most of them have smooth leaves and rather large spines though not stiff. A few species hold their flower heads six to twelve inches above the leaves.

CANISTRUM

The genus *Canistrum* was named from "kanos", a basket, referring to inflorescence in a basket of leaves. The canistrums, generally, much larger plants than the other two genera, have their compact flower heads on long stems that rise above the center although few species hold the

Aechmea phanerophlebia: Photo by Mulford B. Foster.

Plate 9

flowers deep in the nest. The flower heads are surrounded by a rim of colorful bracts that rise one to two inches above the flowers, which are mostly white. The leaves, covered with fine scales, are rather leathery in texture.

The fruits of all three of these genera are born and matured under water; they are smooth, globular or ovate shaped, holding many small seeds in a gelatin-like substance. A number of species of all three of these genera with similarly constructed plants have been known to horticulture for over fifty years and some of them were to be found in every bromeliad collection. In their native habitat most of them grow near the ground-level on trees, or rocks and the majority of them are native to Brazil.

CRYPTANTHUS

For quite a number of years the interesting genus *Cryptanthus,* has held the fancy of plant lovers and of late years some of the common species have been used in dish gardens. These weird, crinkly leaved rosettes with their colorful markings are quite distinct in form from all the other bromeliads. *Crypt* meaning hidden and *anthos* a flower, easily describes the nature of the genus. They all have white flowers which are found in the center of the plant barely emerging from the leaves. Nearly all of the species grow in low spreading rosettes, although *C. maritimus,* a new species, I found just a short distance from the ocean in Brazil, is a twelve-inch tall, narrow-leaved, grass-like plant. Most of the cryptanthi are rock and shade loving plants but *C. bahianus* is a terrestrial plant growing in the cactus desert regions and has thick, stiff succulent leaves.

The cryptanthi have two kinds of flowers, the center cluster is composed of male or staminate flowers and under the bracts surrounding the center cluster appear the perfect flowers with both pistil and stamens. The three sided fruits are rather large and fleshy, but have very few seeds and are quite hidden between the bases of the central leaves.

QUESNELIA

The genus *Quesnelia* was named for M. Quesnelonce, French Consul at Cayenne. The quesnelias which are found principally in Brazil are an interesting group. I have taken every known species in its native habitat and added one new one to the group. *Q. liboniana* which was called *Billbergia liboniana* until more recent years, does resemble a *Billbergia* in its tubular form with its drooping inflorescence. The coastal types, however, like *Q. arvensis, Q. quesneliana* and *Q. testudo* have much more distinctive character in their flower heads which emerge from a densely leaved plant. These three have similar inflorescences. One could easily imagine that their glorious pink flower heads made up of crinkly bracts which look like crepe paper from under which peep dark blue flowers, were some fantastic creation, but they live and thrive quite normally (with the aid of the pollinator, the humming-bird) on the seacoast. *Q. quesneliana* seems just about as happy on fiddler crab tidewater as the heavy white sand just a few feet from the ocean high tide limit.

HOHENBERGIA, GRAVISIA and WITTMACKIA

Hohenbergia, Gravisia and *Wittmackia* are three genera that would be difficult for the layman to recognize because of their resemblance to the aechmeas; they differ principally in structural parts of flower and fruit which only the specialist would determine, but they have similar forms and habits of growth.

ACANTHOSTACHYS

One of the few monotypic genera is *Acanthostachys* (thorny and trailing leaves). The single species *A. strobilacea* is a truly epiphytic plant. From a distance, with its drooping, almost terete leaves, hanging from a tree branch it gives the appearance of one of the epiphytic cacti such as *Rhipsalis*. The spines on the curled edges of the leaf margins and the fruit emerging from near the end of the leaves, looking somewhat like a miniature pineapple, assure you that this strange plant is really a bromeliad. The red bracts encase yellow flowers. The white fruit matures in one year having large seeds which are as sticky as though they were born in a pot of glue.

I have treated nearly half of the genera in this interesting family, endeavoring to look at them with the eye of a plant lover who desires more information than just how to grow a plant and give it a common name. This attempt is to make only a simple eye-key, to avoid too many technicalities, but to familiarize one with some of their simpler technical points of structure. Unfortunately there has been no book written for the layman about bromeliads in any language. Many botanists have avoided them because of the difficulty in collecting and making herbarium material. But we hope the future holds a treatise which will give the layman a complete picture of the bromeliads.

A SURVEY OF BROMELIADS IN HORTICULTURE

MULFORD B. AND RACINE FOSTER

It is difficult to trace many details in the history of bromeliads previous to the 19th century but we do know that during the time of the explorations of Columbus, Amerigo Vespucci, Oviedo and Portuguese explorers, the first bromeliad, *Ananas* (from the Brazilian Guarani Indian word "Anana") was taken back to Europe and then carried around the world. It took root and flourished in almost every tropical country such as India, Java, Sumatra, Philippines (wherever the old explorers went) including the little island of the Moluccas, Amboina, where Rumph became acquainted with the pineapple and described it in his great botanical work HERBARIUM AMBOINENSE some fifty years before it was published in 1741.

Oviedo, however, preceded Rumph by over two hundred years with the illustration of the pineapple in his HISTORIA GENERAL DE LAS

INDIAS published in 1535. This is said to be the first illustration of a pineapple but Rumph remains the first botanist to describe it.

It has been stated that as early as 1549 the pineapple was in horticulture in India. Undoubtedly, the rapidly growing pineapple thrived in all tropical countries where it was taken from the old sailing vessels. In those days of year-long voyages, possibly no other tropical fruit could have been so easily transported; the span of life in a pineapple fruit, plus the months that the leafy top could survive long after the fruit was gone, would give it an advantage over about any fruit or plant.

J. G. Baker records that Lord Portland introduced the pineapple into England in 1690, but there is no record of fruit production until 1712 in the garden of Sir Mathew Decker in Richmond.

It is possible that Linnaeus, the Swedish botanist and father of modern botanical nomenclature, was the first one to have any wide recognition of his bromeliad botanical publications as written in the SPECIES PLANTARUM in the year 1753 twelve years after the work of Rumph. The two genera (fourteen species) which Linnaeus recognized, *Bromelia* and *Tillandsia,* were both given by him to honor Swedish botanists, but these genera have now been divided into several other genera, including *Ananas* which he had called *Bromelia.*

Significantly, Linnaeus' publication of his description of bromeliads was preceded some twenty years by the Mark Catesby colored plate of *Viscum cariophylloides augustifolium*[1] in his magnificent work THE NATURAL HISTORY OF THE CAROLINAS, FLORIDA AND THE BAHAMAS (1730). Catesby's illustration is reproduced in Plate 10. This great book with charming hand colored plates of birds, frogs, snakes and plants of the southeastern United States probably contains the first account of an epiphytic bromeliad, and that from Florida, which is now called *Tillandsia fasciculata.* In his quaint description of this "Viscum" Catesby mentions the similarity in plant form of this *Tillandsia* to that of the *Ananas,* pineapple, a very astute observation; quoting him, "from the root grow many concave Leaves, folded in a manner like those of the Ananas."

The name *Ananas,* thus was known and used years before Linnaeus disregarded it, and because, man is first more interested in what feeds his stomach rather than his soul, it was many years before the decorative "stove" or house plants caught the fancy of the horticulturist.

We can only partially trace the fluctuating attention which bromeliads have received in horticultural circles during the past hundred years. The rise and decline of this interest makes a zigzag graph.

Since the first botanists and collectors who became horticulturally interested in this family were Europeans, principally German, French, Swedish, Belgian, and English, bromeliads as living plants were introduced into their countries first. For the most part they became new and amazing additions to the principal botanical gardens such as Liége,

[1] The word *Viscum* prefixed Catesby's description of all plants which adhered to trees including orchids, bromeliads, ferns, mistletoe, etc.

Tillandsia fasciculata

Reproduction of the first drawing of a Florida bromeliad by Mark Catesby, and published in 1730 as **Viscum caryophylloides angustifolium** in "The Natural History of Carolina, Florida and the Bahamas." It is now known as **Tillandsia fasciculata.**

Plate 10

Kew, Paris, St. Petersburg and Berlin and only gradually entered private collections.

And although concentrated effort at collecting them started early in the 19th century (Spix and Martius 1817-1820 expedition) they really did not have notable popularity until some fifty years later when André and Morren went wild over them. True, Glaziou, distinguished botanist and landscape artist, in the thirteen years he spent in Brazil from 1858, had a special penchant for BROMELIACEAE and has the distinction of having found some sixty-five new species of his favorite family, but bromeliads were not in the ascendancy until the 1870's. During the early years of the 19th century, although bromeliads were around, there was a woeful lack of widespread interest in them.

If the number of entries in current magazines of that day are any barometer as to their popularity, we find the temperature very low. GARDNERS' CHRONICLE of England which started in 1841 contained a few brief notices of bromeliads in the first twenty-five to thirty years; we are thinking mainly of the decorative, epiphytic, easily cultivated bromeliads. *Ananas* or pineapple was frequently given attention, throughout many early years, proving that a satisfied palate has priority over decorative beauty. Then a rise in the decorative bromeliad barometer took place as indicated by the notices in the GARDNERS' CHRONICLE of the years, roughly between 1870 and 1900. Much enthusiasm gained momentum in England during these years, indicated also in THE GARDEN and PAXTON'S BOTANICAL MAGAZINE, culminated, perhaps by Baker's HANDBOOK OF THE BROMELIACEAE published in 1889. To this day this small volume remains the only text of its kind in English.

Even in the later part of the 19th century when there was a decided rise in attention to bromeliads, especially on the Continent, these laments are recorded in THE GARDEN of December 17, 1892, when speaking of *Tillandsia Lindenii*, "It is difficult to understand the unpopularity of bromeliaceous plants in this country [England] when one sees this *Tillandsia* . . ." etc.

On February 18, 1888 this appeared as an editorial:

"It has long been a source of regret to me that the taste for these plants has so much declined of late years amongst lovers of plants in England. And this is all the more impressed upon my mind whenever I visit any Continental garden, especially those in Belgium where large collections of these plants are to be found and where they are much prized. I am glad to record, however, that here in this country I find places where their cultivation is being taken up. W.H.G."

Evidently editor W. H. G. was quite taken with the unique beauty of bromeliads and couldn't tolerate the indifference of the majority of plant fanciers. Yet, *Tillandsia Lindenii* in the year 1870 had been given a first class certificate by the Royal Horticultural Society.

From THE GARDEN again, for March 24, 1888, when speaking of *Vriesia brachystachys* one of the editors said, "Pretty though many of its class are by no means popular, and it is quite the exception to find them represented in gardens. In the case of some, the leaves alone en-

title them to a high place among ornamental foliage plants. Though so neglected in this country, many of the bromeliads are very popular on the Continent.''

Here and there bromeliad seed or plant importation notices in the various horticultural journals give the historical touch that make plant lovers across the years reach out and shake hands.

A Mr. Rogers says, ''I received this plant from Mr. Parkinson of Mexico in 1838 . . . *Tillandsia rubida* imported from Brazil by Messrs. Loddiges . . . introduced to the Gardens of Plants at Paris by M. Eugene Melinon who got it in Cayenne, [French Guiana] . . . indebted to C. B. Warner, native of Rio, for *Vriesia psittacina* . . . imported from Rio in 1841 by Lt. C. Smith, presented to Sir Charles Lemon, the *Pitcairnia micrantha.*''

In Edinborough someone acquired seeds from Trinidad of *Billbergia nudicaulis* (now in the genus *Aechmea)* but promptly mistreated it by suspending it on wires where, in spite of its mistreatment it did thrive for sometime. This is one of the few aechmeas that could have stood an unsuitable substitute for a tree trunk.

The Botanical Cabinet and the Botanical Register (Lindley, editor), the Garden and Forest and the Journal of Horticulture and the Botanical Magazine (Sir W. Hooker, editor) all gave the bromeliads space now and then, but the bromeliad ''temperature'' in England was not high.

The warmest enthusiasm which predominated in the later 19th century was in France and Belgium where bromeliads were championed long and loudly by André and Morren. For twenty years each of these men concentrated every effort and enthusiasm toward the bromeliads. Morren published descriptions constantly in La Belgique Horticole and he contributed 250 of his own water-color drawings in this family mainly between 1865 and 1885. These magnificent plates now repose at Kew Gardens in London. In the preface to Baker's Handbook he says that at that time ''Prof. Edouard Morren of Liége was universally and deservedly regarded for the twenty years previous to his death, in 1885, as the highest authority on the plants of this order.''

Edouard André, like Glaziou was a landscape architect, and he became so infatuated with the family that he made the difficult and tedious exploration to Colombia (then known as New Granada), South America, where he collected mainly bromeliads. When we consider the long ocean journey, the poor equipment and the hazards of much wilder country than now exists, we bow with respect to what André accomplished in gathering his more than eighty new species of bromeliads. And his monumental work in his Bromeliaceae Andreanae along with the description of the trip in his Le Tour de Monde (described by L. B. Smith in this issue) cannot be underestimated in the advancing enlightment of bromeliads.

During the late years of the 19th century other notable collectors such as Kalbrayer, Zahn, Wallis, Bruchmueller, Roezl, Werkelé, Blanchet, Ule, Wawra, St. Hilaire, Broadway and Weberbaur, all contributed their share to this amazing Pineapple Family; the collectors were auto-

matically mentioned in the current horticultural publications and thereby linked with the editors who championed bromeliads such as Gressen (Le Jardin) Duval and André of France, Linden and Morren of Belgium, Sir W. Hooker of England, Regel of St. Petersburg and Wittmack of Germany.

The nurserymen such as Bull and Veitch in England, Jacob-Makoy in Belgium, Binot, Chantrier and Duval in France, Booth and Verschaffelt in Germany, play an equally important role in putting bromeliads "on the map." Libon and Saunders are not to be forgotten among those who by their tender care brought many a sad looking collected plant into recovery and fruition, or nursed frail seeds through babyhood to maturity.

Many collectors sent home live bromeliads, always some few of which survived. Epiphytic bromeliads did not hold up too well on the long journeys out of the jungle tightly packed, either too wet or too dry during the long journey by mule and then by boat. Terrestrial, hardier, dry land types came through with greater percentage.

In the United States practically all of the bromeliad importations came in before August 20, 1912 when the Plant Quarantine law was passed. From that time on it has been very difficult to import bromeliads alive as the U. S. Department of Agriculture has not yet perfected a method of fumigation which does not affect bromeliads seriously. Terrestrial forms seem to stand the fumigation with very little fatality and the xerophytic epiphytes such as tillandsias and aechmeas come next in endurance of fumigation. But the vriesias and guzmanias, most of those with tender leaves, seem to be unable to "take it."

Orchids have been imported in such quantities that the government has made the effort to protect them from death in fumigation, but the little known bromeliad has received very little attention, hence the great loss at Quarantine.

However, by personally packing and accompanying our many plants from our two expeditions in Brazil we were able to successfully bring through many plants, although the loss by fumigation was most pathetic. These importations have constituted practically the only new introductions of bromeliads into American horticulture since the 1912 Quarantine.

With the advent of the 20th century and rumblings of war on the horizon in Europe, during the first twenty years of the century it is difficult to trace the progress of bromeliads and their boosters. Indications in the Revue Horticole show that interest in France early in the century took on a low "temperature," possibly due to the passing of André. In England, the Kew Gardens 1915 Handlist had approximately 260 species and hybrids in thirty-one genera, a very notable collection. We have been anxious to obtain data on the extent of the collections in Berlin, Liége, St. Petersburg and Paris during these years, but have not been able to track down just what they had. Attention to bromeliads in the early 20th century in Europe was mostly scientific as indicated by the outstanding treatment of bromeliads as a whole by Harms and by the stupendous work of Mez's monograph.

Recently we have acquired a price list which was issued by Albert Schenkel in Hamburg, Germany with the dates 1936, '39, '40. Some seventy-three species in fifteen genera are listed, indicating that there was still horticultural interest in bromeliads up to the time of the World War II. We are looking forward to the time when we can go to Europe for a thorough investigation into the horticultural history of the bromeliads.

What about bromeliads in horticulture in America during the 19th century? They were very scarce in the "new" country; people were busy pushing out frontiers, the climate was cold, Florida and California were too young to have any hothouse plants so "refined" as the curious bromeliads of horticulture, although Florida has over a dozen species of the family growing natively.

Undoubtedly, here and there, in some of the finer private collections where lovely conservatories were fashionable, bromeliads from European importation found a resting spot. Mr. Burke of Latham Park, Pennsylvania, and the city of Philadelphia in Fairmount Park, we know had them thirty-six years ago. The Buffalo Botanical Garden made exchanges with Henry Nerhling, and undoubtedly in these early days the New York, Missouri and Brooklyn Botanical Gardens all had the beginnings of their bromeliad collections.

Very much to our surprise in an old catalogue of Pitcher and Manda, of Short Hills, New Jersey, having a probable date of about 1893 we find over a page of their catalogue devoted to seventy-six species in some sixteen genera of our favorite family. Of course, many of these names have now gone into synonomy, yet the number of different bromeliads is quite imposing for this period of time.

Julius Roehrs was one of the early bromel boosters and grew quite a stock of them but what his early collection was we do not know. The Julius Roehrs Company's 1940 and 1943 price list has nine genera with roughly 33 species and varieties.

In California, plantsmen found bromeliads curious and worth a try. In the early days of the 20th century W. I. Beecroft of Escondido, did considerable importing of bromeliads and received, as he says, plants such as *Billbergia Lietzii* and *Vriesia splendens* from L. R. Russell of Richmond, England. Some plants came from Haage & Schmidt in Erfurt, Germany as well as some from Jules Chantrier of Paris, among which were *Billbergia zebrina, B. Moreliana,* (now *B. vittata) B. Saundersii, B. Leitzii* and *Aechmea fasciata.* Theodore Mead of Oviedo, Florida sent Beecroft his own hybrid of *Billbergia nutans* crossed with *Cryptanthus Beuckerii* and Beecroft introduced it into California.

Charles Cass of San Diego was also one of the early champions of bromeliads, having at one time, fifteen species in *Billbergia* and eight in *Aechmea,* fifteen in *Tillandsia* and a scattered few in eight other genera.

David Barry, outstanding bromeliad enthusiast of Los Angeles, started early in the 1930's in the assembling of bromeliads until it has grown to be the largest private collection in California having twenty-four genera with some 200 species.

In the 1930's the late Richard Atkinson of Leucadia, bought a good many bromeliads from Cass and M. B. Foster and made many exchanges over the country; he started a rather large project, but a few years later in about 1943 sold most of his collection to Evans and Reeves of Los Angeles who list some twenty-one species in *Tillandsia,* fifteen in *Aechmea,* two in *Quesnelia* and twenty-two in *Billbergia* (some of which are synonomyous) in their collection (1942), but list for sale in 1943 a much smaller collection.

The catalogue of the Knickerbacker Nursery in San Diego (Neff Bakkers) has had listings of a few bromeliads since 1935.

Mr. Edwin O. Orpet at Santa Barbara has long held a fondness for the bromeliads and has had a number of species and seedlings. Long remembered will be the dazzling *Puya alpestris* which flowered in his garden in 1932.

Mr. J. N. Giridlian of Oakhurst Gardens at Arcadia, lists a number of bromeliads in his recent catalogues principally four genera comprising twenty-one species.

Mr. Cecil Houdyshel, of La Verne, Calif., lists billbergias.

In Florida in the early 20th century bromeliads had but few boosters, but the names of C. T. Simpson, Reasoner's Royal Palm Nurseries, Oneco, Henry Nerhling, Mr. Codwise and Theodore L. Mead will always be remembered as having had considerable interest in bromeliads.

In these earliest days Henry Nerhling was the real champion and enthusiast. His correspondence with numerous collectors and nurserymen of Europe and with Theodore L. Mead of Oviedo, was endless zealous praise for the ravishing bromeliads. His notes as published in the *American Eagle* in the early 1920's, and more recently in 1940's, reprinted and published in book form, are perhaps the most eloquent and most ardent words written in English in praise of bromeliads. It more nearly parallels the praise of the Europeans.

Mr. Nerhling's interests were more intense and varied than possibly any other one plantsman in Florida. He was over zealous in his indomitable search for plants that might adorn our Florida gardens. Of all the different plant families represented in his collection he did the most work with *Caladium,* and while Mr. Nerhling was hybridizing and working arduously with *Caladium,* Mr. Mead was taking on bromeliads and *Amaryllis* which had been the favorites of Mr. Nerhling. Each, became better known through their work in these shifted hobbies.

By this time Mead had almost given up the work he started with orchids, and although he always kept a few in his collection the bromeliads almost pushed orchids off the benches in his greenhouse and from the branches of the trees in his garden.

From 1905 up until 1923 all of Mead's plant records dealt almost exclusively with orchids. Then he apparently made his first trade of a bromeliad with Mr. Nerhling. From then on he started his first hybridization of bromeliads, and from 1926 on, almost all of his hybridizing was done in this family up until April 1936 shortly before his death. During that ten years he hybridized everything within the family re-

gardless of the nearness of the genera. During that time he had living plants of sixteen genera.

So far as we can determine there was absolutely no system nor method in mind for he would just as soon cross such distantly related bromeliads as the pineapple with Spanish Moss, or *Dyckia* with a *Billbergia*, as he would have any two species within the same genus. Cross pollinating flowers was an obsession with him.

He did finally get two bi-generic crosses, *Billbergia nutans X Cryptanthus Beuckerii* and *B. nutans X C. bahianus.* Apparently the only cross outside of the billbergias that materialized was *Neoregelia spectabilis* (then called *Aregelia)* crossed with *Neorgelia marmorata* (then called *Nidularium).*

Mr. Mead did originate some amusing names of his hybrids on *Billbergia nutans: nusau (nutans* with *saundersii), nuspec (nutans* with *speciosa), nuze (nutans* with *zebrina) nuleo (nutans* with *leopoldi) nuvit (nutans* with *vittata).*

So far as we can learn there was not one resultant hybrid that he attempted with the aechmeas, tillandsias, vriesias etc. In the billbergias he made about all the combinations that could be made by using principally *Billbergia nutans* and *B. pyramidalis* as the maternal parents. However, practically everyone of these *Billbergia* hybrids had been previously made in Europe and most of them are listed in the Kew Botanical Garden Handlist of 1915.

Long to be remembered is the day Mr. Mead saw *Bromelia serra* blooming in our garden at Orlando; he was immensely thrilled, like a child, and made a return trip to procure the fully opened flower for the pollen.

Both the Nehrling and Mead collections finally disappeared but now a very interesting growth of neoregelias is planted under the old oaks of Mr. Nehrling's former home at Gotha. Julian Nally, the present owner, is a bromeliad enthusiast and has quite a number of species in his collection. It seems right that they should be growing on that estate.

The Foster interest in bromeliads began in 1928 when by exchange a plant of *Aechmea miniata discolor* was acquired. In 1931 and 1932 first exchanges of plants were made with Mr. Mead. Seeing his collection spurred on the interest considerably and whenever possible members were added to the collection. Then the Mexican trips of 1935, 1936 and 1937 brought the bromeliad temperature up considerably. In 1938 our trip to Cuba and a personal contact with Dr. Lyman B. Smith of the Gray Herbarium increased our interest in bromels beyond that of just plant lovers.

In 1939 and 1940 on our Brazilian trips of six months each the bromeliads won first place in our hearts and our garden. From these two trips we brought back hundreds of collected plants. So far Dr. Smith has published some sixty-five of them as new species and varieties and there are quite a number yet to be published.

Our living collection now has over 400 species and hybrids representing thirty-five of the fifty known genera (Plate 11); the Foster price

Plate 11 Bromeliads in the Foster greenhouse at Orlando, Florida

list of 1942 offered fifty-seven in twelve genera while the 1945 price list offered seventy-five species in seventeen genera.

Before this writing is published we will have flown to South America, this time to Colombia, collecting in the footsteps of André, seeking bromeliads in the Andes.

Other recent American collectors such as Stanley, Steyermark, Schultes, Killip, Lundell, Woodson, Hitchcook, Pennell and others of the United States, while Castellanos, Hoehne, Cuatrecasas, Looser, Osten, Cardenas, Vargas of South America have added innumerable new species of bromeliads and have added much knowledge concerning the family.

In 1942 we started writing about bromeliads and now cannot seem to find any stopping point. T. H. Everett of the N. Y. Botanical Garden writing his Plant Portraits in the GARDENER'S CHRONICLE of America described several of the bromeliads in the last two years; Lad Cutak in September 1945 MISSOURI BOTANICAL GARDEN BULLETIN, handled the subject very well in a comprehensive survey of the family; Montague Free took it up in the April 1946 HOME GARDEN.

No horticultural survey is complete without a glimpse of the botanists who through their untiring efforts plow through a maze of dried specimens and countless records in order to trace and place plants in their taxonomic relationship and order. At best it is a thankless job.

The botanical work of Mez, Harms (German) and Baker (English) has been mentioned before, the work of Beer (German), Lindman, Wittrock and Regnel (Swedish) can be added. And not to be overlooked is the botanical paper on the genera *Ananas* and *Pseudananas* by Felisberto C. Camargo, a Brazilian botanist.

But the recent contributions to BROMELIACEAE are largely from the American botanist, Dr. Lyman B. Smith whose work has brought about many important revisions in this family and who is now recognized as the world's outstanding authority in this group.

After years of bromeliad interest abroad, botanically and horticulturally, it is fitting that the concentration of both botanical and horticultural interest now becomes centered in the Western Hemisphere, native land of the bromeliads.

BROMELIADS IN SOUTHERN CALIFORNIA

DAVID BARRY, JR.

Mark Twain has been quoted as saying that although the banana will live in California, it does not like to. With the exception of the xerophytic types, he could have said the same about bromeliads. Consider that no bromeliad is native to California and that none could be persuaded to live without the aid of man, with the possible exception of some of the terrestrial species. Most of Southern California is of semi-desert characteristics as far as climate is concerned, with low humidity and a moderate rainfall restricted to part of the year. Without the grower providing humidity by artificial means epiphytic bromeliads can not survive. Even Spanish moss, the ubiquitous bromeliad of so many Southern States, will soon dry to wisps, even when placed in apparently amenable situations near the coast.

As such a wealth of plant material of engaging interest can be made to thrive in the open and without elaborate preparation, lath or glass houses are not resorted to by the average plant enthusiast. In view of the artificially created conditions being required, the culture of epiphytic bromeliads has been rare until very recent years.

An exception must be made to this generalization in the case of *Billbergia nutans*. For years this plant has been stocked by most nurseries. It is fairly common in California gardens, being given the careless attention accorded the geranium. Sometimes it is called the "Friendship Plant," supposedly to be given only by one friend to another, a pretty fantasy for one of the less spectacular members of the great bromeliad family, promising well for its popularity when bromeliads are better known.

Within recent years the principal bromeliad grower and collector, in Southern California, was the late Richard G. Atkinson. At Leucadia, a small-community on the coast about one hundred miles south of Los Angeles, Atkinson brought together about two hundred species and numerous varieties and hybrids. Most of the plants were grown under glass in an unheated house. Humidity was supplied by frequent sprinkling of the benches and walks. Many species were grown in great quantity from seed. His cultural methods induced rapid growth, such as thirty months from seed to flower in some of the *Billbergia* hybrids. Sufficient plants were propagated for broad commercial distribution. The collection was acquired and offered at retail by one of the larger Los Angeles nurseries, Evans and Reeves. This distribution has been the most important single factor in the recent popularization of this plant family in California, bringing to growers acquaintance with *Nidularium fulgens* (Fig. 6) *Aechmea Weilbachii, caudata, miniata, fasciata, fulgens, pectinata* (Fig. 6) and *bracteata; Billbergia pyramidalis, amoena, Euphemiae, Quesnelia arvensis* (Plate 12), many *Billbergia* hybrids, *Neoregelia* species and hybrids, and many others. A *Nidularium* hybrid is shown in Plate 13.

Atkinson's passing was a loss to California horticulture. He was a great enthusiast, a perfectionist, and a capable grower. With unusual patience he took many remarkably fine kodachrome pictures of these plants at the height of inflorescence. The collection of these pictures, mounted as slides, was posthumously presented to Dr. Lyman B. Smith of the Gray Herbarium.

Fig. 6. *Aechmea pectinata,* height 23 inches, width 40 inches, and *Nidularium fulgens,* height 8 inches, width 15 inches (inset at left). Photo by Ladislaus Cutak of plants in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif.

Among those who acquired a collection of the Atkinson epiphytic bromeliads from Evans and Reeves was Mrs. Emmeline Carpentier of Hope Ranch Park, adjoining the City of Santa Barbara on the north. On a rolling mesa, not far from the Pacific, and under glass Mrs. Carpentier has grown quantities of these plants to an astonishing perfection. In fact, the condition of these plants is so superb that Mrs.

Quesnalia arvensis

This specimen has 57 leaves; height 20 inches; width 30 inches. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, California.

Plate 12

Carpentier should be given the title of "Peer of American Bromeliad Growers," and the interesting question presents itself if these plants are not superior in size and inflorescence to the plants in their respective native habitats, where presumably optimum conditions obtain.

Epiphytic bromeliads in California are grown under glass, or, in Southern California under lath-house conditions near the coast. Proximity to the Pacific brings relatively a freedom from killing frosts. With the large body of air over the ocean not going to extremes of temperature, the adjacent air above the coastal plain shares in the moderating effect of the ocean. As to frosts, the heavy freeze of 1937 has not since been repeated. The ability of epiphytic bromeliads to withstand heavy frosts has not been thoroughly tested. Perhaps the wider growing of the plants which has taken place since 1937 will afford the opportunity.

The generally recommended method of planting bromeliads is to use fibrous peat, either osmunda, or, if orchids are grown also, to use the broken down osmunda discarded when they are repotted in fresh osmunda.

In California, the usual methor is to plant bromeliads in a compost mixture. The generalization can be made, at least of Southern California soils, that they are neutral or alkaline. Bromeliads like a soil on the acid side. The water from most of the municipal water systems is like the soil, either neutral or alkaline. Thus, watering plants in osmunda will not bring a desirable acid condition to the material, even though the osmunda may initially test as being neutral or slightly acid. A properly prepared potting mixture will furnish not only a desirable degree of acidity, but food value as well.

The Metropolitan Water District of Southern California distributes free a leaflet entitled "SUGGESTIONS FOR GROWING ACID-LOVING PLANTS WITH COLORADO RIVER AQUEDUCT WATER." Although written primarily for growers of begonias, camellias, gardenias and azaleas, many of the problems and recommended solutions should be valuable to growers of bromeliads. In the main, reliability is placed on using peat moss or leaf mold to produce acidity from pH 5 to 6 for a considerable time with alkaline water. Most bromeliad growers follow in general the same plan. For example, the potting mixture used by Richard G. Atkinson, measured carefully, is 4 parts of light loam soil, 3 parts of well-decomposed leaf mold, 2 parts manure, and 1 part each of sharp sand and of peat.

The mixture used by Mrs. Emmeline Carpentier contains no loam soil. The leaf mold is decomposed to a soil condition. Well decomposed manure is added, with sharp sand, rice charcoal and Humenal. The last item is a kind of peat prepared in Germany and impregnated with chemicals of high food value, probably with a chemical such as sulphate of ammonia. Her bromeliads are watered with rain water collected in a cistern from the roof of the greenhouse. Sprinkling the house to maintain humidity is done two or three times daily in average weather with water from the local mains. No artificial heat is used in the glass house. An unusual amount of ventilation is provided. There are no

vents at the ridge. Small side vents near the ground are nearly always open. At each end of the house near the top is an exhaust fan, about thirty inches in diameter, which operates whenever the temperature in the house rises above 78 degrees F. One obvious advantage of watering and syringing the plants with rain water is the freedom from the grey spots usually evident on the dark leaves of bromeliads when regularly available water is used. The minerals dissolved in the water in minute quantities show grey where the drops have dried.

Where rapid propagation is desired, potting the plants lower in the soil than they would be found growing naturally will stimulate eyes to produce off-shoots which otherwise may remain dormant, or never develop. Reference is made to the illustration of *Aechmea Weilbachii* with six off-shoots before the parent plant has flowered (Fig. 7). As a rule, off-shoots are produced after inflorescence.

Fig. 7. *Aechmea Weilbachii* planted deeply to stimulate production of off-shoots. Note the six off-shoots. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif.

Tillandsias should be more widely grown in California. Their ornamental value is not well recognized. Many species do not hold water in their leaf rosettes, such as *Tillandsia bulbosa, Andreuxii, dianthoidea,* and *filifera.* Such kinds of tillandsias should be able to

Nidularium hybrid

The author, David Barry, Jr. is shown with this specimen for purpose of giving comparison as to size. Photo by Ladislaus Cutak of plant in the collection of Mrs. Emmeline Carpentier, Santa Barbara, Calif

Plate 13

endure more frost than the softer-leaved species which collect and hold water. Much interest is added to plant groups by their bizarre forms and habit of profusely "blushing" during flowering. So many orchid growers persist in cultivating orchids only. If a few tillandsias should be placed in hanging baskets, or rafts, their houses would take on an added interest and the lack of variety would be agreeably relieved.

Dr. T. H. Goodspeed of the Department of Botany, University of California, distributed seeds of terrestial bromeliads collected in his Botanical Garden Expeditions to the Andes taken in the late 1930's. The cultivation of the plants grown from these seeds centers in the Henry E. Huntington Botanical Garden at San Marino. There the plants are perfectly at home, making suitable additions to the extensive cactus collection. Huge groups of puyas and pitcairnias are on display. These plants belong in large gardens. A single plant with its off-shoots and sharp spines soon becomes an object too formidable for the yard. In spite of their more tropical origins than that of many of the puyas, bromelias thrive in the open in the Southern California coastal belt. When bromelias are better known many gardeners will condone their spiny nature in order to be able to enjoy their spectacular inflorescences.

The tremendously increased interest throughout the United States in the cultivation of orchids, which has taken place within the last three or four years should be reflected in a greater interest in their companion epiphytes, the bromeliads. Living naturally together in the Americas, they should be grown together in greenhouses. Most orchid collections are unattractive as to form yet attractive as to flower; bromeliads are attractive as to form and often of great floral beauty. The two plant families can be used as a supplement to one another to bring about a definite horticultural advantage.

BROMELIADS AT THE MISSOURI BOTANICAL GARDEN

LADISLAUS CUTAK
Missouri Botanical Garden

The Missouri Botanical Garden always did possess a rather fine collection of BROMELIACEAE. When checking back on the old accession lists one will immediately see that bromels occupied a prominent position on the Garden's exotic menu. A good many of the specimens were raised from seed but living plants were also acquired from various American and European institutions, commercial concerns and private fanciers. In the early days a representative collection was maintained on exhibition but it is only in the last four years that a greatly enlarged program for acquiring and studying these plants has been established.

Bromels have enjoyed a certain amount of popularity from the very beginning but very little literature has materialized from the fad. In fact, about the only material available are the so-called monographs written in more or less technical language and accessible to a chosen few. Lack of popular literature on the subject has relegated bromels into near-oblivion as far as the general garden-minded public is concerned. This condition need not be because bromeliads are a group of plants with fascinating possibilities and deserve a place in horticulture along with cacti, succulents, orchids and other exotic flora. The Missouri Botanical Garden is destined to play an important role in developing an intense interest in these plants.

Pitcairnia latifolia seems to be the oldest recorded bromel in the Garden's collection. No one now living knows when the original stock was acquired but in 1895 it was already listed on the books with this notation, 'propagation from an old plant in the Garden, source unknown.'' It may be of interest to mention that in the early days propagations from plants were made annually or as the case would warrant and each new propagation received a new accession number. This practice now has been discontinued and all propagations retain the original accession number given it when the plant was first registered. The odd *Acanthostachys strobilacea* was raised from seed 48 years ago and several others date back to the close of the last century. Bromeliaceous plants, as a rule, do not attain great age; individual rosettes usually die off after flowering but new shoots are developed from the old rootstock to insure perpetuation of the species.

Although most of the bromels at the Garden are grown in pots, a great number of them are placed in beds of the Palm House and Cactus House or are grown on the trunks of trees where they seem to thrive under simulating conditions of their natural habitats. It is surprising what remarkable growths some of the species make when grown in the ground. *Aechmea bracteata,* for instance, produces a vase of tightly clasping leaves, 2 or 3 feet high, when grown in a pot but when set out

in the ground assumes another character. The tightly clasping leaves elongate and spread out in loose rosette fashion, the strapshaped leaves often attaining a length of 7 or 8 feet. *Aechmea distichantha* also produces an elongated oval receptacle in a pot but when planted out becomes a mass of spreading leaves. Some of the neoregelias and nidulariums, although of epiphytic tendency, do equally as well as terrestrials. The ornamental-leaved forms like *Neoregelia marmorata,* if grown in shade, will completely lose its vivid blotches and become entirely green.

Last winter the Cactus House was renovated, or at least a start towards that end was begun. South African euphorbias, which played a prominent role in that room for many years, were removed and in their place the beds were prepared to welcome bromeliads of the desert type (Plate 14). The kind that grow in desert regions mostly belong to such genera as *Dyckia, Encholirium, Bromelia, Ananas, Pseudananas, Hechtia, Puya* and *Pitcairnia,* although all species necessarily are not xerophilous in the strict sense of the word. Desert bromels seem to be the least represented in collections, not because they are not attractive but because up to the present they were not available to collectors. The best known of the desert bromels are the dyckias, yet surprisingly only 3 or 4 species are commonly cultivated and only two or three are frequently found in catalogs, these being *Dyckia sulphurea, D. rariflora, D. altissima* or *D. remotiflora,* although more than 70 are known to exist in nature. Most of them, or more than half the number, are native to Brazil while the remaining are scattered through Paraguay, Argentina, Bolivia and Uruguay. Members of this group look like small century plants and require about the same care. *Dyckia sulphurea* and *D. rariflora* make excellent pot plants and usually fill a container with their rigid rosettes in quick time. Because of their suckering habit, dyckias become fast propagators or will make solid masses in beds if allowed to continue for years in the greenhouse and in the open in warmer climes. A good many of the species remain small but soon become quite large. *Dyckia rariflora* is one of the small kinds with dark green, rigid leaves and with a short flower-stock bearing orange colored blossoms. The plant was first discovered in 1830 and became an instant favorite. In our collection we have the following species:

Dyckia altissima
Dyckia brevifolia
Dyckia encholirioides
Dyckia floribunda
Dyckia leptostachya
Dyckia maritima
Dyckia microcalyx
Dyckia Niederleinii
Dyckia rariflora
Dyckia remotiflora
Dyckia remotiflora var. *montevidensis*
Dyckia sulphurea

The next best xerophytic group is *Puya* and there are about 90 species in existence. They prefer steep stony slopes of the Andes Mountains; the greatest number of species occurring in Peru and Bolivia. Many of these become exceedingly large for pot culture but are frequently grown in California gardens where they thrive exceedingly well. The best collection of puyas will be found at the Huntington Botanical Garden in San Marino where they often cover large areas and become a wonderful sight during the flowering season. Because a good many

Xerophytic bromels growing in the Cactus House at the Missouri Botanical Garden; Bromelia serra in bloom. Photo by Ladislaus Cutak.

Plate 14

grow at high altitudes they will stand considerable cold weather and even frost, but there are doubts whether any would withstand the winters in the Midwest. One of the superb species is *Puya alpestris,* a Chilean endemic, with a short trunk that bears an immense rigid tuft of spreading and recurved leaves. Its flower-stalk is more than 3 ft. high and bears a pyramidal panicle of blue flowers. Apparently there are two forms of *P. alpestris,* one being a dwarf variety. Seedling plants are excellent when planted in novelty containers. Another well known member is *P. chilensis.* It also develops a good-sized trunk and when in flower becomes a most striking attraction. The thick flower-stalk, more than 4 ft. high, shoots up from the center of the leaf rosette and bears a spike of large deep greenish or sulphur yellow flowers. One of the most massive of all bromels is *Puya Raimondii,* native to the Peruvian Cordilleras, whose trunks are often used for roof timbers by the highland Indians. There is still another huge monarch, *P. gigas* of Colombia, which sends up flowering spikes 20 to 30 feet into the air from rosettes of hard and thick, prickly-toothed leaves. A smaller stemless species is *P. spathacea* from Argentina. It is the first *Puya* to bloom in our collection and an interesting one with large dull and blue flowers. *P. dasylirioides* is the only North American representative of the genus and is found in Costa Rica. The garden does not possess an outstanding collection of puyas as yet but one must take into consideration that no attempt had been made to secure species of this genus until a few years ago. Even at that I doubt whether more than a dozen species are in cultivation. Then, too, puyas require lots of room for development and for this reason are not generally grown in greenhouse collections of botanical institutions.

The genus *Pitcairnia* is not necessarily xerophytic but is treated that way at the Garden and its members seem not to mind the desert conditions given them. Nearly 200 species are recorded but only 50 or so make their home in Central America, the rest being South American or West Indian. As a rule, all are terrestrial but occasionally a few will be found epiphytic growing in crotches of trees. The most distinct and decorative is *P. corallina* of Colombia, which resembles the amaryllidaceous weevil plant *(Curculigo recurvata)* more than any other member of the BROMELIACEAE. Like the *Curculigo,* each leaf has a stiff erect petiole about a foot long and the blade is plicate; however the dense drooping racemes of large spreading coral red flowers immediately make it recognizable as belonging to the Pineapple Family. The plant makes thick colonies and can be used to good advantage as a hedge or border plant. The flower-spike is peculiar in that it does not grow erect like the rest of the pitcairnias but has a tendency to creep on the ground. Another fine plant is *P. xanthocalyx,* native to Santo Domingo. This one has long, narrow, grass-like leaves that droop in pleasing fashion and reveal silvery undersides. The flower-stalk attains a length of 2 or 3 feet and bears yellowish blooms in profusion. It, too, can be used effectively as a border plant. *P. latifolia* is likewise of grass-like habit, similar to the preceding, but has more colorful blossoms in that they are dark red and keep on flowering for several weeks. One of the dwarfs

is *P. Andreana,* native to Colombia.. Although it is insignificant in comparison with all others it does produce some lovely flowers of exquisite shade, being scarlet to bright yellow. Our collection consists of the following:

Pitcairnia Andreana
Pitcairnia corallina
Pitcairnia ferruginea
Pitcairnia latifolia
Pitcairnia maidifolia
Pitcairnia punicea
Pitcairnia undulata
Pitcairnia xanthocalyx
Pitcairnia Maroni (hybrid)

In my estimation the genus *Bromelia* contains some of the most spectacular members in the BROMELIACEAE. They are all terrestrial and prefer dry locations. Some 30 species are known to exist in northern South America, the West Indies and Central America. One of the oldest is *Bromelia Pinguin,* already described in 1753 by Linnaeus. Most of the bromelias are rather conspicuous on account of their size. At the same time they are one of the most wicked groups in the entire family. The leaves are beset with marginal prickles that really are vicious and can lacerate flesh terribly if care in handling is not taken. In tropic regions some of the species are often planted for hedges to repel animals from the premises. When the plants are about to bloom the center leaves color up magnificently, either pink or brilliant red. Then a compact white woolly head makes its appearance and for two or three weeks rose or lavender flowers protrude from the woolly mass.

Neoglaziovia is an interesting unpretentious bromel found in Brazil from which fiber is extracted for cloth and rope. There are only two species described but apparently are rare in collections, if cultivated at all. Our specimen of *Neoglaziovia variegata* came from Mulford Foster, who collected it in Bahia on one of his excursions. The stiff tufted plants are terrestrial and in appearance somewhat resemble sansevierias. Leaves of *N. variegata* are narrow and long, usually glabrous and when young conspicuously marked with lighter transverse bands. Its flowers are like those of *Billbergia,* of a violet color and quite showy. The other species, *N. concolor,* is shorter in stature and is not striped like the former but rather more uniformly white-lepidote.

Deuterocohnia species are shrubby perennials of xerophytic nature from South America. Only 6 or 7 species are recorded and none are in the trade as far as I can ascertain. They look more like *Dyckia* and can hardly be distinguished from that group when flowers are not present. We are fortunate to possess *D. Meziana,* a new species discovered by Mr. Foster in Brazil. This rock-loving bromeliad sends up a branched woody inflorescence 4 to 7 ft. in height and blooms over a period of six or seven years.

Ananas, the true pineapple, grows best in a porous, well drained soil and is capable of withstanding protracted drought. Thus it is adaptable to culture in the Cactus House, where several plants are now established. Many varieties of the edible pineapple have been developed since white man first laid his eyes upon this luscious fruit and since pineapples are readily available one can get a good start by cutting off

the crowns, letting them callous tor a few days, and then planting in sandy soil. The pineapple may have originated in Brazil although no one is sure of that. Its origin is lost in antiquity and was already a cultivated plant in the American tropics at the time the first white man came to this continent.

Hechtia species can best be described as coarse herbs with rosettes of prickly leaves, very thick and rigid in texture. It would be difficult to distinguish them from dyckias in the absence of flowers. Almost exclusively hechtias are Mexican, except for one species that grows in Texas and two or three others that are found in Guatemala. Over 30 species have been recorded but it is quite possible that many more exist and will come into prominence before long. Here again is practically an unknown group in cultivation which should be brought to the attention of unique plant fanciers. Hechtias grow well in pots and will make good house plants. Most of them possess a silvery cast due to the abundance of small scurfy scales which cover the undersides of leaves in all species. The earliest *Hechtia* on record is *H. stenopetala* described in 1835 from the vicinity of Mexico City and five years later the second species *(H. glomerata)* was recorded. At least 11 new species have been described by Dr. Lyman B. Smith, present monographer of the BROMELIACEAE, since 1937. The best known *Hechtia* and easiest one to get is *H. texensis,* which is widely distributed over southern and western parts of Texas. It makes dense rosettes, composed of many linear-triangular, spine margined, silvery green leaves and sends up an erect flowering stalk about 3 feet high with white flowers.

Encholirium is still another xerophytic genus that looks very much like the better known *Dyckia,* especially in vegetative characters. As is the case with most xerophytic bromeliads, encholiriums are not known to be in cultivation, except in a very few gardens. The group numbers only a few species and is entirely Brazilian. Foster discovered two new ones, *E. Hoehneanum* and *E. horridum,* growing on bare rocky slopes, the former in Bahia and the latter in the state of Espirito Santo. We are fortunate to possess *E. Hoehneanum* but it will be a long time before it may come into blossom.

Tillandsias are one of the most fascinating groups in the Pineapple Family. They are the most widely distributed of all the bromel groups. In their northern limits they reach the Dismal Swamp in Virginia and in the southern extremity extend way below Buenos Aires in Argentina. Many of the *Tillandsia* species, and there are approximately 400 or more described, are epiphytic in moist surroundings but others prefer dry locations, growing among boulders, on rocks and even on the prickly stems of torch cacti in desert regions. *Tillandsia recurvata* is the most common bromel which can be found on arborescent Cerei. Contrary to general belief it does not derive any nourishment whatsoever from the cactus but merely attaches itself to it for support. This little bromeliad, in fact, is not particular about its host; you will often find it suspended on telegraph and telephone wires. A very close relative and perhaps the most abundant epiphyte along the coastal regions of the Atlantic is *T. usneoides,* known as the Spanish Moss, which decorates the Live

Oaks, Cypresses, Cabbage Palms and other trees with streamers of silver-green. It has no roots whatsoever and its threadlike stems and leaves merely hang in long festoons from the tree branches. The leaves and stems are covered with tiny silver gray scales which hold moisture for the plant's sustenance. It is the most unusual bromel because it does not

Fig. 8. Scarlet Torch Plant, *Billbergia thyrsoidea* in bloom. Photo by Ladislaus Cutak.

resemble any other member in the family. The great majority of tillandsias produce stiff leaves in a compact rosette, either large or small, and bear flower-stalks of either violet, rose, blue, yellow, green or white tubular flowers. Most of the time the inflorescence is composed of elongated distichous spikes or sometimes reduced to a cluster of single

flowers almost hidden by the leaves. There is a small tufted epiphytic species, only 3 or 4 inches high, which should be included in every collection. It is *T. ionantha* of Mexico. There are 40 to 70 narrowly lanceolate-triangular leaves in a dense rosette, white lepidote throughout, but with more coarser spreading scales in the lower half, appearing to the naked eye as if coated with grains of sugar. When the rosette is about to flower the center leaves turn a brilliant red pink and then dark violet flowers emerge half concealed by the leaves. It can be successfully grown in a soil mixture composed of sand, loam and leafmold but care should be exercised to be sparing with the loam. The most outstanding of all tillandsias is *T. Lindeniana,* native to Ecuador and Peru. It is definitely epiphytic and stemless. Each rosette bears a dense cluster of stiffish, gracefully recurving, narrow leaves. The 7-inch long, stout scape arises from the center of the leaf cluster and supports an oblong-lanceolate spike composed of densely imbricate red-pink bracts from which issue beautiful, spreading amethyst violet flowers. A very striking relative is *T. Lindeni* but it has a shorter and more fan-shaped inflorescence than *T. Lindeniana.* The flower bracts are brighter, being a lovely purple pink. Tillandsias are very abundant in Florida, the commonest, outside of the Spanish Moss, being *T. fasciculata* which often is sold in department stores under the enticing name of Florida Orchid. In this country it often is the first species that comes into the possession of a bromel enthusiast.

At the GARDEN an effort is being made to grow bromels on trees in the Palm House (Plate 15). At first potted plants were attached to the trunks by means of palm fiber but in time the fiber rotted and the bromels fell from their perches. Now when plants are intended for trees most of the osmunda or peatmoss is removed from the roots and the plants stapled to the palms for security. Only a thin slab of moss is placed between the roots and trunk for the sole purpose of encouraging the root cluster to get established on the trunk. After the plant is firmly established it cannot be dislodged so easily and will continue to set forth new offshoots for many years. Only the more plentiful species in our collection are being tried out on trunks, as the vast majority are still being, and will be grown in pots. *Aechmea pectinata* does exceedingly well on *Washingtonia* palms. It produces broad leaves and grows in a birdnest fashion, thus cluttering a palm trunk most attractively with bright green foliage. *Aechmea Racinae* is one of the most attractice epiphytes of this group. Foster discovered it in Brazil and it was named for his wife. It is quite different from all other aechmeas in that it possesses a most startling pendent inflorescence with individual flowers of bright red, pale yellow-chrome and black. Another attractive *Aechmea* is *Ae. fulgens* var. *discolor* from French Guiana. Its broad strap-shaped leaves, blackish purple on the undersides, form a vase-like rosette a foot or more high. A pyramidal flower spike of rich scarlet red grows from the center of the living vase and supports small, oval shaped, thick flowers of rich red and deep blue. The berries last for a long time and hold their color for several months. *Ae. miniata* var. *discolor* is likewise noteworthy, but can best be described as being paler than the above. The

Aechmea pectinata

—growing on Washingtonia Palm at the Missouri Botanical Garden; the vine is Philodendron cordatum. Photo by Ladislaus Cutak.

Plate 15

tongue-shaped leaves are three inches wide, dark green above and violet carmine underneath, more or less glaucous on both surfaces. The inflorescence is a moderately dense panicle supporting sessile flowers of flesh color, deep red and lilac. Both *Ae. fulgens* var. *discolor* and *Ae. miniata* var. *discolor* are obtainable in the trade.

I think it might be appropriate to list here some of the outstanding members of the BROMELIACEAE now cultivated in the Garden. We are always willing to exchange or receive new material to augment our growing collection and further studies on this fascinating group of the plant kingdom.

Acanthostachys strobilacea

Aechmea aureo-rosea
bracteata
bromeliifolia
distichantha
fasciata
Fosteriana
fulgens
fulgens var. *discolor*
Lindeni
Mertensii
mexicana
miniata var. *discolor*
nudicaulis var. *cuspidata*
Orlandiana
Ortgiesii
pectinata (Plate 15)
Pineliana
pubescens
Racinae
recurvata
victoriana
Weilbachii

Ananas bracteatus
bracteatus var. *alba*
comosus

Androlepis Skinneri

Araeococcus micranthus

Billbergia amoena
Euphemiae
Euphemiae var. *nudiflora*
horrida var. *tigrina*
iridifolia
macrocalyx
macrolepis
Meyeri
nutans
pallidiflora
Porteana
pyramidalis
Saundersii
thyrsoidea (Fig. 8)
Tweediana
vittata
zebrina

Bromelia antiacantha
Balansae
serra (plate 14)

Canistrum roseum
eburneum

Catopsis Morreniana

Cryptanthus acaulis
acaulis var. *discolor*
acaulis var. *diversifolius*
acaulis var. *bromelioides*
bahiensis
Beuckeri
bivittatus
zonatus

Deuterocohnia Meziana

Dyckia altissima
brevifolia
encholirioides
floribunda
leptostachya
maritima
microcalyx
Niederleinii
rariflora
remotiflora
remotiflora var. *montevidensis*
sulphurea

Encholirium Hoehneanum

Gravisia exsudans

Greigia sphacelata

Guzmania monostachya
musaica
Zahnii

Hechtia glomerata
texensis

Hohenbergia catingae
penduliflora
stellata

Lindmania penduliflora

Neoglaziovia variegata

Neoregelia ampullacea
Carolinae
concentrica
cyanea
laevis
marmorata
Pineliana
sarmentosa var. *chlorosticta*
spectabilis
tristis

Nidularium amazonicum
fulgens
Innocentii
Innocentii var. *striatum*
Innocentii var. *lineatum*
procerum

Orthophytum foliosum

Pitcairnia Andreana
corallina
ferruginea
imbricata
latifolia
maidifolia
X Maroni
punicea
undulata
xanthocalyx

Portea petropolitana var. *extensa*

Pseudananas macrodontes

Puya alpestris
assurgens
chilensis
spathacea

Quesnelia arvensis
humilis
Liboniana

Streptocalyx floribundus

Tillandsia albida
anceps
Baileyi
Balbisiana
bulbosa
Butzii
decomposita
fasciculata
grandis
ionantha
juncea
Leiboldiana
Lindeni
Lindeniana
recurvata
Schiedeana
streptophylla
tenuifolia
tricolor
usneoides
utriculata

Vriesia bituminosa
Fosteriana
guttata
hieroglyphica
X Mariae
regina
scalaris
Schwackeana
splendens

Wittmackia lingulata

COLOR IN BROMELIADS

RACINE FOSTER

For those who like colorful flowers with accents in flaming reds, its shades and tints, and their contrasting colors, complete satisfaction will be found in the bromeliad family. In fact the bromeliads radiate about all the colors of the spectrum. Their brilliant color combinations are made up on the basis of the three primary colors, blue, red and yellow. But the one outstanding color in the bromeliad inflorescences is red and the great gamut of shades and tints thereof.

When one reviews all the blue-reds, the yellow-reds, the cerises, the pinks, brilliant and pale which are found in flower stem, bracts, sepals and petals of this one family of bromeliads, one is astonished with the great range of their colorful beauty. And their complimentary colors making brilliant contrasts are often quite breath-taking.

If one is planning a collection of bromeliads it might be interesting to consider your favorite combination of colors and aim toward either a group of bromeliads with all those colors you like best or with the idea in mind of a combination of great contrast in the colors.

There is one foregone conclusion, in making up a collection of bromeliads, you most surely must like red and its various shades, which, of course, go into pink, because the majority of the bromeliads have red or its tints in some place or other.

I. Under the red-blue combination we list:

Aechmea Weilbachi has a red stem, red stem bracts, lower half of sepals is red while the upper half is lavender, and the petals are lavender.

Aechmea Victoriana has shaded red tones on sepals, purple petals with white "piping" on edge.

Billbergia vittata has purplish-red stem, red bracts, red sepals, purple petals.

Quesnelia humilis has red bracts on light stem, red sepals, red flower bract, cerise red petals.

Tillandsia ionantha has royal purple flowers with yellow stamens, a "jewel" in a cluster of brilliant red leaves.

Quesnelia liboniana has salmon red sepals, purplish-blue petals, with a whitish base.

Quesnelia testudo has watermelon pink bracts which make up the closely formed head; sky blue petals show between bracts.

Nidulariums, all have red centers with blue or purple flowers.

Billbergia Euphemia has pink bracts with a powdery effect, sepals are pale to white with lavender petals.

Tillandsia Lindenii has periwinkle blue flowers with rose-pink and green bracts.

There are many more in the blue and red combination, but these are a good starter in thinking about the bromeliad color combinations.

II. In the orange-red-yellow combinations we find a nice selection:

Aechmea Lindenii has orange to red tinge on sepals with yellow petals, a stunning color combination of two very close colors.

Aechmea Racinae has red-orange sepals, brilliant yellow petals with black base.

Vriesia carinata hybrid (Marie) has red and yellow on sepals, with yellow petals, inflorescence lasts six months.

Gravisia aquilegia has orange sepals with orange petals.

Aechmea Orlandiana has orange stem, orange bracts, white sepals, whitish-light yellow petals.

III. The red and yellow combinations offer some striking plants:

Aechmea ramosa has red stem, red bracts, yellow sepals, yellow petals.

Aechmea pineliana has large, light red bracts on stem, light green sepals, yellow petals, and these turn black with age.

Aechmea Fosteriana has maroon bracts, green sepals, yellow flowers.

Billbergia Lietzii has pink bracts, white to yellow petals.

Billbergia iridifolia concolor has pink bracts, yellow sepals and petals.

Vriesia carinata hybrid (Marie) has red and yellow sepals with yellow petals, (inflorescence lasts six months).

Aechmea bromeliafolia has soft red to pink scattered bracts on stem, pale green sepals, yellow flowers which turn black.

IV. The red and green combinations is a smaller group but is quite lovely:

Billbergia amoena has red bracts, green sepals with blue tip and green petals with blue tip.

Billbergia distachia has pink stem bracts, green sepals with blue tip, and green petals.

Aechmea Fosteriana, as above, maroon bracts, green sepals, yellow flowers.

V. Some of the tillandsias have lovely pink and white combinations of color:

Tillandsia polina has salmon-pink sepals and white petals, and is highly recommended for this combination.

BROMELIAD TIME OF FLOWERING CALENDAR

Racine Foster

For a year around continuance of bloom in your bromeliad collection, this calendar guide may help you choose your next species. It is based on observations made under greenhouse conditions in Florida.

January—
- *Billbergia Lietzii*
- *Billbergia iridifolia concolor*
- *Billbergia vittata*
- *Aechmea bromeliafolia*
- *Quesnelia testudo*
- *Aechmea Victoriana*

February and March—
- *Aechmea pineliana*
- *Aechmea Fosteriana*
- *Aechmea Racinae* (some bloom in December)
- *Billbergia amoena*
- *Billbergia distachia*
- *Billbergia Euphemia*
- *Quesnelia humilis*
- *Quesnelia liboniana*
- *Tillandsia Butzi*
- *Tillandsia pruinosa*
- *Tillandsia ionantha* (April also)
- *Vriesia penulata*

March and April—
- *Tillandsia fasciculariа*
- *Vriesia guttata*
- *Vriesia simplex*

May and June—
- *Aechmea miniata discolor* (in a warm season their period is advanced)
- *Aechmea marmorata*
- *Aechmea nudicaulis*
- *Billbergia zebrina*
- *Billbergia amoena*
- *Billbergia Saundersii*
- *Cryptanthopsis navioides*
- *Gravisia aquilegia*
- *Guzmania Zahni*
- *Neoregelia bahianus*
- *Neoregelia tristis*
- *Vriesia ensiformis*
- *Vriesia splendens*

July—
- *Aechmea fulgens discolor*
- *Neoregelia spectabilis*
- *Neoregelia marmorata*

August—
- *Aechmea fasciata*

September—
- *Aechmea purpurea-rosea*
- *Aechmea remotiflora*
- *Billbergia iridifolia*
- *Billbergia pyramidalis*
- *Billbergia amoena*

October—
- *Billbergia vittata*
- *Vriesia carinata*

November—
- *Aechmea bracteata*
- *Tillandsia Lindenii*

December—
- *Aechmea Racinae*
- *Tillandsia Lindeniana*
- *Aechmea Wielbackii*
- *Aechmea Orlandiana*
- *Aechmea Victoriana*

SPANISH MOSS AS AN ECONOMIC PLANT

WYNDHAM HAYWARD

Tillandsia usneoides Linn., the artistic, if melancholy gray Spanish Moss of the Lower South, has perhaps contributed more to the lives of the peoples of its native area than any other one plant in its omnipresent quality as a characteristic member of the endemic flora. It has earned itself a place in art, song and fable, agriculture and industry.

Spanish Moss is a distinctive plant, lending its typical drooping streamers to the Southern landscape with an effectiveness comparable only to that of the live oak, the pine tree and palmetto. It is a silvery gray plant, soft and flexible, found as far north as Eastern Virginia and extending around the Atlantic and Gulf coasts to lower Texas, and down into the American tropics.

It hangs from trees on slender stems, not at all a parasite, but drawing its sustenance from the moisture, carbon dioxide and dust of the atmosphere, usually hooked over a twig, jutting limb or crotch. It grows fast, so that a live oak tree in Florida may be "demossed," as the operation of removing the "moss" is called, and still need a new "demossing" in half a dozen years. It is of course impossible to remove every wisp of the Spanish Moss from the bark of a large tree, and the remnants soon grow and increase, and new plants also arise from seeds blown from nearby trees. The "moss" may grow so heavily in a tree as to endanger its life (the tree). In shady, damp locations this is more likely than in open, sunny, exposed places where the wind has free play with the bearded "moss" and frequently blows big hanks to the ground, where it will die in a few months. It is strictly an aerial thing and cannot be grown in soil.

While not providing a palatable and nutritious human food like the Pineapple, its rival as a useful member of the bromeliads, the Spanish Moss is useful indeed to the country people of the South. The fibre is also used in upholstery for stuffing, in fact has been an important item for the upholstery of a certain well-known inexpensive make of car. Gathering of the "moss" for sale of the fibre is a popular livelihood in times of depression. During the early 1930's there was an active business in this in Florida. Now that times are prosperous and easy money available, little "moss" is collected. It is a tedious and laborious work, and the return is slight. The "moss" is collected from trees where it may be found the thickest, by the ton in live oak hammocks or high land woods, subjected to a "retting" process which sloughs off the scaly, felt-like exterior of the "moss," and leaves the black wiry inside fibre which is tough and springy when properly prepared. Soaking in water or various solutions accomplishes this retting process. Afterward the fibre is washed, rinsed, dried and shipped.

Spanish Moss in poor crop years and in generally hard times is widely used by countryside dairy operators, and home owners of a backyard cow, for cattle feed. The cows, if hungry enough, will eat it, although its feed value is presumably low, and its main value something like beet pulp, as a form of roughage. It is not recommended for this pur-

pose, but is resorted to, by farmers and others when unable to provide proper diary and stock feeds. It has not been observed to benefit the cattle, but doubtless helps to fill up an otherwise aching void. In times of prosperity, cattlemen have little recourse to this expedient.

The ''moss'' is also a popular packing medium, although its use in interstate transit is forbidden unless inspected because of pests it is believed to harbor, as various scales, and it is an excellent thing to wrap around the roots of rose bushes and tomato plants and such things when sold at retail. The roots of citrus trees and other nursery stock are often wrapped in the ''moss'' for shipping within the State of Florida. It is used to make growing screens hung on wires in the yard; a ''moss'' house is a cheap and satisfactory substitute for a commercial lath house, if carefully constructed. Hanks of the ''moss'' are draped over chicken wire or barbed wire on poles. in many Southern nurseries, for half-shade.

The Spanish Moss is doubtless so called because it came to the attention of American plantsmen from the Deep South when that was part of the Spanish Colonial Empire, possibly during the 18th century. As a Linnean plant, it has a long and respectable botanical history. No one has determined the first mention of the plant in European literatures, but doubtless the early voyagers with Columbus came into contact with it somewhat in the Caribbean area, or Ponce de Leon found it on the East Coast of Florida in the early 16th century. Fernando De Soto had to wade through miles of it. There is a somewhat facetious myth of its origin that De Soto, wearing a full gray beard, pursued an Indian maid through the forest, and up into a live oak tree where he caught his whiskers among the branches, so that he was able to extricate himself only with difficulty, and in the meantime the Indian maid escaped. The tree retained several wisps of De Soto's gray beard after he released himself, and these, as the story goes, grew on to become our well-beloved Spanish Moss.

The plant is sometimes grown in Northern conservatories but relatively high humidity is required to maintain it.

BIOGRAPHICAL SKETCHES

1. MULFORD B. FOSTER AND RACINE FOSTER

[The reader is referred to Plate 1 for portraits of the Fosters.]

MULFORD B. FOSTER

After graduating from High School at Elmer, New Jersey, where he was born in 1888, Mulford B. Foster went to Philadelphia and completed a course in business college. This his father had urged since he knew that his son's love of nature did not make him too practical in the line of business. He was employed for four years in Philadelphia banks, but every spare moment on week-ends he was off in the woods collecting plants, reptiles and other animals. His interest in reptiles developed to the point where he had the largest private collection of living specimens in the country at that time.

At the age of 22 years he went back to Elmer, New Jersey as an associate editor on his father's newspaper, not because there was any particular desire to become a newspaperman, but because he wanted to be associated with his father. But the call of nature was too strong. After about two years as a newspaperman, he moved to the mountains of Pennsylvania. He spent his summer months as a leader with several boys' camps, and in winter he lectured on natural history subjects, particularly on reptiles, to schools, colleges, Y. M. C. A.'s and boy-scout groups.

A few years later he became the representative of the Davey Tree Expert Company in the States of Virginia and Maryland, and Washington, D. C., which position he held for five years. His naturalist inclinations soon led him to photography, and finally to painting at the age of 36 years. His painting, without any formal training, developed in transitory stages from realistic, to abstract, to philosophical, and finally again to realistic plant portraits and botanical subjects. The very beautiful cover design of this First Bromeliaceae Edition of Plant Life, and the 36 charming bromel portraits shown in Plates 6, 7 and 8, are convincing evidence of Mr. Foster's abundant talents.

A trip to Florida in 1923 decided for him that this was the land for a plant enthusiast and his instinctive urge for building gardens soon launched him as a landscape architect in Florida where he has been building gardens for more than two decades. His home and extensive plant collections are located in the utterly beautiful City of Orlando, in the central Florida lake region.

Not at all satisfied to grow and plant the tropical and sub-tropical plants that others had collected and introduced into horticulture, Mr. Foster was bent on getting his own plants. He, and Mrs. Foster, therefore went on collecting trips to Mexico, Cuba, Brazil and currently in Colombia. From these trips he has reintroduced many old plants and discovered many new ones, principally over 80 new bromeliads. In recent years he has written on the subject of bromeliads which has become his

principal interest. The number of living bromeliads in his orchidario in Orlando, Florida exceeds that of any other collection.

RACINE FOSTER

Racine Foster was born in the State of Wisconsin in 1910, where she attended grade and high schools, and college. This included three years at Lawrence Conservatory of Music, and two years at the University of Wisconsin. She held several different positions, including church organist and private tutor. In 1935 she married Mulford B. Foster, and has been studying tropical plants with her husband ever since.

—*H. P. T.*

2. LYMAN B. SMITH

An autobiographical sketch

Bromeliaceously speaking, life began for me in the fall of 1926 when I met the family at the start of my graduate work at Harvard. Until that time I had been strictly a local flora botanist but since then bromels have been my dominant interest and line of research.

After two years of graduate study I had the very good fortune to receive a Sheldon Travelling Fellowship to go to eastern Brazil. There I was able to observe the elusive bromel in its native state, which is to say an elevated position difficult if not impossible to attain. Also I was able to ponder the great difference between the live bromel and its dessicated relict in the herbarium—a difference which I still find amazing and at times embarrassing.

One more year of graduate study and I finished my thesis, a monograph of one subgenus of *Tillandsia* and an account of the bromels of British Guiana. This combination of monographic and floristic work set the pattern for my later research.

On the monographic side I have been publishing serially an artificial synopsis of the subfamily *Tillandsioideae* in an attempt to overcome the difficulties of identifying the usual incomplete herbarium material by guessing at the characters of absent petals and stamens. Also from time to time I have made keyed summaries of such genera as *Lindmania, Brocchinia, Hechtia, Navia, Guzmania, Greigia* and *Ananas* and have covered all the species of *Catopsis, Glomeropitcairnia, Ochagavia* and *Androlepsis* in the course of floristic work.

Floristically I have covered the bromels for North America as a whole and for Yucatan, Costa Rica, Panama, and Trinidad and Tobago individually. In South America I have published accounts for British Guiana, Peru, Uruguay and in large part for Chile. To compensate for my lack of field experience I have frequently worked with the botanists most familiar with the territory involved. In some cases we published jointly and in others my papers were the richer for much information I could never have obtained alone.

As a member of the staff of the Gray Herbarium since 1931, I have had the advantage of a great library and collection as a constant support

to my research. This situation and the steady influx of bromels for determination has led me to strengthen the side where my greatest advantage already lay and to spend most of the time I could find for travel, in visiting other herbaria to study and photograph their types of bromels. Up to 1935 I had gone to Europe three different times and had done considerable work at the British Museum, Kew, Brussels, Liége and Paris.

Most of my spare time in late years has gone into the preparation of a treatment of the *Bromeliaceae* for Dr. F. C. Hoehne's "Flora Brasilica." At present I have completed descriptions of nearly five hundred species, or about a third of the whole family, and the majority of the accompanying keys. The work has been greatly encouraged and en-

Fig. 9. Lyman B. Smith

hanced by the monumental collections of Mulford and Racine Foster—collections which are doubly valuable because both dried and living.

3. DAVID BARRY, JR.

An autobiographical sketch

[The reader is referred to Plate 13 for portrait of David Barry, Jr.]

The writer was born in the State of Texas, but has been a Californian for most of his life (since 1902). Some intense interest beyond his real estate development work was an essential of his search for happiness. First came aviculture. For the last dozen years his avocation has been the introduction and culture of tropical plants, especially palms, but including also cyads, aroids, bromeliads, and lately, orchids. Before the war, the conduct of "an international palm seed exchange service," which

sent, received, and redistributed palm seeds between governmental departments of agriculture and botanic gardens throughout the world, was carried on. This service afforded much material for experimenting in the introduction of new palms for California. Little work had been done in this field for the twenty to thirty previous years. Some successful new introductions were made, but the efforts resulted mostly in failures as one might expect. The work however gave much specialized experience. In 1941, some plant exploration work was carried on in western Cuba, and in Florida. The Florida visit was highlighted by a trip into the Everglades with his good friend and fellow bromeliad enthusiast, sharp-eyed Mulford B. Foster.

Fig. 10. Ladislaus Cutak

4. LADISLAUS CUTAK

Ladislaus Cutak has been associated with the Missouri Botanical Garden in St. Louis for the past 20 years. In 1933 he was placed in charge of the main Conservatories, housing the exotic flora, at the early age of 25 years. He specializes in desert plants, particularly cacti and the other succulents, but he is equally at home with cycads, palms, bromeliads and various jungle vegetation. He is recognized as one of the outstanding authorities on cacti. He has done much toward the popularizing of cacti and the other succulents. Since 1932 he has contributed more than 125

articles to various outstanding horticultural magazines, and he frequently collaborates with other authors on scientific books.

Cutak devotes a goodly portion of his time to lectures, for he is frequently called upon to speak before garden clubs, civic, religious and social societies throughout the country. All of his talks are illustrated with colored slides made from his own photographs. In recognition of his many lectures and writings on succulent plants he has been appointed to life fellowship in the CACTUS AND SUCCULENT SOCIETY OF AMERICA.

He also has done extensive exploring for plants in the deserts of the Southwest and Mexico, covering some 30,000 miles in his wanderings, searching for seeds, herbarium and living material to enhance the collections at the Missouri Botanical Garden.

—*H. P. T.*

FOSTER & FOSTER'S "BRAZIL, ORCHID OF THE TROPICS"

BETTY CARRUTHERS DILL

[The following review of the book, BRAZIL, ORCHID OF THE TROPICS, by Mulford and Racine Foster, Harper & Bros., N. Y., 1945. $3.00, appeared in part in the Daily Times-Herald, Dallas, Texas, and is here reproduced by special permission.—*Ed.*]

If you are a garden enthusiast, a lover of flowers, or just an armchair adventurer, you'll enjoy every minute on excursions with the Fosters through jungles, up mountains, along the sea, searching for the "air garden" paradises of Brazil, native land of orchids and bromeliads. If you happen to be fortunate enough to rank as a professional naturalist, botanist, or orchidist, this fascinating book is a must for you.

With the two naturalists, Mulford B. and Racine Foster, you first board a small cargo ship, the TROUBADOUR, and sixteen days later you anchor with them at midnight in magical Guanabara Bay, the port of Río, under a full moon. "It was as if all the stars of the heaven and the pearls of the sea were strung on an invisible thread and draped around the Bay of Río."

You are led through "air gardens" where orchids grow as thick and luxurious as daisies on a plain at home, overwhelming in their vivid colorings and honey sweetness of perfume—where bromeliads hang in giant trees in the jungle, weighing from fifty to a hundred pounds; where the natives wonder why the "professores" wish to take alive "*gravata*" or "*parasita*"; where the hummingbird, (Beija-flor) flower-kisser, a native of Brazil also, is found sipping the nectar from the most brilliant flower bracts and flowers.

Every State or town or city in Brazil used by the Fosters as headquarters for their various excursions, is graphically described for the reader, with especial emphasis on customs, topography and the people themselves. These include Río, of course, with its superb Museo Nacional and Jardin Botánico. Then São Paulo, Bahía, Ilhéos, Agua Preta, loca-

tion of the Cacao Experiment Station; Jacobina, Mt. Itatiaya, where they stayed the night at a genuine "Swiss Chalet" mountain retreat; the small State of Espírito Santo (State of the Holy Ghost) where they found rich specimens of bromeliads growing on the "Finger of God" (Dedo de Deus); Victoria of the same State; Paraná, Bello Horizonte, Santa Barbara and the Monastery of Caraca, where the lovely camellia "tree" almost a hundred years old, shook pure white blossoms over them like a benediction; and finally out to Matto Grosso and Corumbá and Urucúm.

"Brazil, Orchid of the Tropics," is profusely illustrated with black and white photographs, kodachromes and sketches by Mulford B. Foster. A map at the beginning, which will intrigue you with the Equator held in place by two grinning monkeys, allows you to follow the Fosters by narrow gauge, "teapot" engines, dugout canoe and burros. True botanists, they discovered more than forty plants never before known to botanical science. Their first new species discovered was a huge *Vriesia*—named *Vriesia Petropolitana,* for the nearby beautiful city of Petropolis, set near lush mountainside jungle. Next was the elephantine plant, a new species, taken high in the giant trees by "monkey" boys, and which was later named, by Dr. Lyman B. Smith, *Aechmea conifera.* Other trips in this vicinity yielded four more new species, as well as other bromels which have not been identified as yet.

Going up to Jacobina on the funny little train Mulford suddenly spied a *Neoglaziovia variegata,* but the train wouldn't stop. For days they searched for another specimen of this interesting and useful bromeliad, whose fiber the Indians have named *caroa,* and which is used for the manufacture of cloth and rope. Then one day, Racine almost stepped on one! And so they tramped from village to village, mountains and jungle, through cold wet places, and hot dry desert, with their sacks of spiny plants, the herbarium press, and other paraphernalia, ever searching. One afternoon in a pouring down rain they found that lovely purple orchid, *Miltonia spectabilis.* Later, over dry granite perpendicular rocks along the sea they scrambled and worked for hours to obtain a specimen of that "spiny devil" a bromeliad which Dr. Smith named appropriately, *Encholirium horridum.* Two of their interesting finds, neither bromeliads or orchids, were the giant bogonia trees, and the *Amaryllis* growing to gigantic proportions in trees!

Not the least interesting items in the book are the personal accounts of the many friends who helped them, beginning with Dr. Lyman B. Smith, bromeliad specialist of the Gray Herbarium at Harvard, with whom the specimens were divided, half of them going to the National Museum at Río. In Brazil there were *Doutora* Bertha Lutz of Río, and director of the Museum, Dona Heloise Alberto Torres, Dr. F. C. Hoehne, one of the most outstanding botanists of Brazil, Dr. Sothenes Miranda of the Cacao Experiment Station, Captain Griete, Roberto Donati, Dr. Rubem Landeiro, plant pathologist, Maria Stella Noveas, orchidist, writer and painter, Augusto Ruschi and his brother Dr. Henriquo of Santa Tereza, and many other fine naturalists and botanists of Brazil, who proved themselves fine friends to the two plant explorers.

"Many people wonder why we will endure so much discomfort and so many hardships on our collecting trip, such as snakes, jungle animals, hot days and freezing cold wet nights, and the question is sometimes difficult to answer. But we know that the greatest compensation is the discovery and realization of our searchings later carrying a message to thousands—like the *Aechmea Orlandiana*—which carries a message directly from 'The Finger of God!' "

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Edited by
Hamilton P. Traub

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VERBENACEAE EDITION COVER DESIGN

The VERBENACEAE EDITION Cover Design, is adapted from the type illustration of *Clerodendrum Thomsonae* Balfour (Trans. Bot. Soc. Edinb. 7: 264-267; pl. 7; 580-581, pl. 16. 1860-1863) by permission of the Botanical Society of Edinburgh. The name "*Thomsonae,*" according to the Rev. W. M. MacCartney, a Scottish Missionary to Africa, recalls "an idyll as lovely as that tropic blossom," *Clerodendrum Thomsonae*—"Over a hundred years ago a girl was born in Scotland. We do not know her name. We do not know her birthplace. We know only two things about her. The first, that she loved flowers and studied them and learned about them. The second, that she fell in love with a schoolmaster called William C. Thomson.

"The young couple did a very brave thing. They volunteered to go to Calabar as missionaries. They were accepted for service abroad. Mr. Thomson was ordained. They were married, said farewell to their friends and sailed for Africa.

"The ship staggered through the Bay of Biscay, lolled with flapping canvas on the oily waters of the Gulf of Guinea where the flying fish skim the waves, and anchored in the mouth of the Calabar River. From Calabar Mr. and Mrs. Thomson traveled by canoe up the Cross River to Ikonetu.

"Mrs. Thomson found that tropical West Africa is not a riot of colour. The trees and bushes are a very dark, glossy green. Only here and there the ivory white of a lily or the vivid red of hibiscus startle the eye by the vigor of their contrast.

"At Ikonetu Mrs. Thomson loved to wander, a lonely figure in a long white dress, along bush paths learning about Africa—and looking for flowers. She had to have flowers--on the table, on the veranda, in the garden of the bungalow.

"When Mrs. Thompson had been a bare three months at Ikonetu she found a plant with clusters of pink flowers. She dug it up by the roots and bore it home in triumph. She tended it carefully for three weeks and the plant—she was sure it was unknown in Europe—survived and began to twine its tendrils toward the bamboo fence of the garden.

"Mrs. Thomson took a queer, an unnatural interest in the plant. When she fell ill of a fever she often talked about it in delirium. When the fever lessened she asked her husband about it. Had it been watered? Was it still living? For days the young bride fought the fever. But the fever won. She died at Ikonetu.

"After her death, Mr. Thomson made a tub and put the plant in it. He sent the plant down river and over the seas to Edinburgh. He wrote a letter to Professor Balfour and asked, if the plant should prove to be new to science, it might be named after his wife.

"The plant was alive when it reached Edinburgh. No one had seen it before. They named it *Clerodendrum Thomsonae.*

"We do not know her name. We do not know her birthplace. Who shall declare her generation? She was twenty-two when she died, in 1858. An unknown Scots girl who loved God and all His creation.

"Her plant still blooms in the Botanical Gardens in Edinburgh. Although it is a thing of fragile beauty it has no perfume. But the fragrance of a dedicated life still lingers." [Quoted by permission from "Life and Work" (Edinburgh), n. s., n. 12. Dec. 1946, p. 283. (subtitle: The Record of the Church of Scotland).]

EDITORIAL NOTE.—Readers will be interested to know that *Clerodendrum Thomsonae* is available in this country. According to a prominent dealer in seeds and plants, it is "A pot plant of much grace and beauty. Flowers are of richest crimson subtended by calyces of snowiest white. Blooms long and freely." Anyone interested may obtain the address on request.

TABLE OF CONTENTS

PAGE

Note on VERBENACEAE EDITION Cover Design 3

Note on PLANT LIFE and HERBERTIA contributors 6

Corrigenda, PLANT LIFE, Vol. 1, nos. 2—3 (1945) 1947 6

Dedication, VERBENACEAE EDITION 7

Autobigraphical sketches—Harold Norman Moldenke and Alma Lance Moldenke 9

A brief historical survey of the Verbenaceae and related families, Harold N. Moldenke and Alma L. Moldenke 13

1. Foreword 13
2. Part I (Historical) 15
3. Part II (Biographical) 46

Explanatory Notes and Literature Citations 90

Addenda 98

Plant Life Library—

Darlington and Ammal's "Chromosome Atlas of Cultivated Plants," Hamilton P. Traub 99

ILLUSTRATIONS

Plate 1 Frontispiece portrait—Dr. Harold Norman Moldenke 8

Plate 2 Portrait—Alma Lance Moldenke 11

Plate 3 *Vitex Agnus-castus* L. (from 1485 edition of "Hortus Sanitatis Deutsch") 17

Plate 4 Description of what is now called *Verbena supina* L. (from 1529 edition of "De Medica Materia Libri V") 19

Plate 5 Discussion of what is now called *Verbena officinalis* L. (from "Icones Plantarum aliquot Hactenus non Sculptarum," 1596, by Gaspard Bauhin 25

Plate 6 Page from first edition, "Species Plantarum" by Linnaeus, 1753, showing descriptions of *Verbenaceae* species 33

Plate 7 Illustration of *Verbena officinalis* L., from 1485 edition of "Hortus Sanitatis Deutsch" 41

Plate 8 Myrmecophily in the *Verbenaceae* 45

Plate 9 Armature in the *Verbenaceae* 47

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem,* if any, *leaves, scape* and *flowers.* Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

CORRIGENDA

PLANT LIFE, VOL. 1, NOS. 2 & 3 (1945) 1947

Cover Design, the initials "M. B. F." in red, at the right base of plant, are indistinct.

Page iii, 3rd line from top, Table of Contents, after "Citations," for "iv" read "iii."

Page iii, line 22 from bottom, for "Cover Design" read "Cover Design, a generalized design representative of the *Bromeliaceae,* by Mulford B. Foster."

Page 84, line 31 from top, for "soon" read "some."

Page 103, about center of page, the book by Mulford and Racine Foster is indicated as published by "Harper & Bros., N. Y., 1945. $3.00." This is an error for the book was originally published by Jacques Cattell Press, but in February, 1947, the book was purchased by the Ronald Press of New York City, and the price is $3.50.

Dedicated to

Harold N. Moldenke

and

Alma L. Moldenke

Dr. Harold N. Moldenke

Plate 1

HAROLD NORMAN AND ALMA LANCE MOLDENKE —AUTOBIOGRAPHICAL SKETCHES

1. HAROLD NORMAN MOLDENKE

Harold Norman Moldenke was born March 11, 1909, at Watchung, N. J., the son of Dr. Charles Edward and Sophia Meta [née Heins] Moldenke. His father was a distinguished Egyptologist, linguist, world-traveler, and collector, author of numerous Egyptological and travel books. An uncle was an internationally known metallurgist, expert on malleable castings, and author of several standard texts on foundry practice. Another uncle was an Assyriologist. His paternal grandfather was a famous Lutheran minister, missionary, educator, and orator, founder of Northwestern College at Watertown, Wisc.

He attended Wardlaw School, Plainfield, N. J. (1919—1920); Susquehanna Academy, Selinsgrove, Pa. (1921—1925); Susquehanna University (1925—1929), being graduated with first honors and the B.S. degree; and Columbia University (1930—1934), where he received the degrees of M.A. and Ph.D. While in college he was student assistant in biology (1926—1929), secretary-treasurer (1925—1926), vice-president (1926—1927), and president (1927—1928) of the Natural Science Club, and a member of the Student Council (1928—1929).

He was awarded a fellowship at the New York Botanical Garden to study algae under the late Dr. M. A. Howe in 1929, was taken on as part-time assistant (1929-1932), Assistant Curator (1932-1937), and finally Associate Curator (since 1937). He was a member of the graduate faculty of Columbia University, in the department of botany, from 1936 to 1942, and has been a member of the board of directors of the John Burroughs Memorial Association since 1938, serving on numerous committees for this organization. In 1935 and 1936 he held a National Research Council fellowship for study abroad and spent over a year studying the preserved and living material of *Verbenaceae* and related groups in most of the larger botanical institutions of Europe, making his headquarters at the Royal Botanic Gardens, Kew, and the British Museum (Natural History).

He has traveled and botanized in 47 states of the United States, the District of Columbia, southern Canada, northern Mexico, Cuba, England, Scotland, France, Belgium, Luxembourg, Germany, Netherlands, Austria, Switzerland, Poland, Czechoslovakia, Norway, Sweden, and Denmark. His botanical collections to date embrace over 19,000 numbers and over 75,000 specimens distributed to the leading herbaria of the world. He was elected to Pi Gamma Mu, national social science honor society, in 1928 and to Sigma Xi, natural science honor society, in 1934; made a Fellow of the American Association for the Advancement of Science in 1938, of the New York Academy of Sciences in 1939, and of the American Geographical Society in 1941. He served as treasurer and Council member of the Torrey Botanical Club from 1937

to 1941 and has served on numerous committees for that organization, including, at present, the Field Committee. He has been co-editor and publisher of the botanical journal "Phytologia" since its inception in 1933, was collaborator for the "Taxonomic Index" from its inception to 1942 and for "Biological Abstracts" since 1933, is a corresponding editor of "Chronica Botanica," has served on the editorial board of Lundell's "Flora of Texas" from 1940 to 1943, and as adviser to the research department of "Life" since 1939. He is a member of the Torrey Botanical Club, Botanical Society of America, American Society of Plant Taxonomists, American Association for the Advancement of Science, New York Academy of Sciences, New York Mycological Society, Yosian Fellowship, John Burroughs Memorial Association, American Geographical Society, Asociación Sudamericana de Fitotaxomistas (Tucumán), and Sociedad Amigos de Flora Brasilica (São Paulo), a sustaining member of the New England Botanical Club, charter member of the Society for the Study of Evolution, and corresponding member of the Sociedad Botanica de México and the Centro de Estudiantes del Doctorado en Ciencias Naturales (Buenos Aires); a past member of the Pennsylvania Alpine Club (1925—1929), National Association of Biology Teachers (1941—1943), and the Indian Association of America (1943).

His chief field of interest is the taxonomy and nomenclature of the *Verbenaceae* and related families, on which subject he has worked for the past 19 years and in the course of which research 102,000 specimens have been studied from 186 of the world's leading herbaria. Other interests include general taxonomy and nomenclature, the flora of Latin America, tautonyms, plants of the Bible, the flora of the Watchung Mountains (N. J.), White Mountains (N. H.), and southern Florida, the compilation of state floras with county records and maps for each species, the vernacular names of plants, general evolution, historical geology, anthropology, ornithology, and philately. His publications to date number 505, covering over 6700 printed pages.

2. ALMA LANCE MOLDENKE

Alma Lance Moldenke [née Ericson] was born on April 29, 1908, in New York City, eldest daughter of John William and Cornelia Frances [née Lance] Ericson.

She attended the New York City public school system, being graduated from Public School No. 68 in 1923, from Wadleigh High School in 1927, and from Hunter College, with the degree of Bachelor of Arts, in 1931. While in high school she was elected to membership in the scholastic honor society "Arista." In college she was active in the local Natural Science Club. After graduation from Hunter she was awarded a scholarship at the Woods Hole Marine Biological Station for the summer of 1931, and was elected to membership in Phi Sigma, natural science honor society. She attended graduate courses in botany and

Alma Lance Moldenke

Plate 2

protozoology at Columbia University and in psychology and education at Teachers College from 1931 to 1938.

During high school and college days she served at various posts in the social service and camping fields in and about New York City. For three seasons she was director of nature study and for two seasons the full director of the Alice Rich Northrop Memorial Camp for nature study, for underprivileged children, at Mount Washington in the southern Berkshire Mountains of Massachusetts. She has served as an instructor in first aid (1931 to 1942) and in nutrition (1940 to 1942) for the American Red Cross, and taught biology and general science in the Model School of Hunter College from 1931 through 1934 and biology and related subjects in Evander Childs High School, Bronx, New York City, since 1934. On September 2, 1942, she married Harold N. Moldenke, with whom she had studied botany in the graduate department of Columbia University.

An ardent travel enthusiast, she has toured and botanized throughout the New England states, through the southern coastal states, and cross-country to Oregon and Washington via several of the national parks.

She is or has been a member of the following scientific and educational societies: Torrey Botanical Club, American Association for the Advancement of Science, National Association of Audubon Societies, School Nature League, School Garden Association, John Burroughs Memorial Association, National Education Association, High School Teachers Association, Biology Teachers Association of New York, and National Association of Biology Teachers, and has served as Corresponding Secretary of the Associate Alumnae of Hunter College from 1934 to 1940 and as member of its Executive Council from 1932 to 1942.

Mrs. Moldenke's chief interests are camping, nature study, first aid work, biology teaching, plant collecting, assisting her husband in his scientific research, and caring for their three year old son, Andrew Ralph, who already is enthusiastic about "flowers." She has published occasional short papers and book reviews in the fields of education, camping, and first aid, and has been co-author of several papers on botanical subjects with her husband.

A BRIEF HISTORICAL SURVEY OF THE VERBENACEAE AND RELATED FAMILIES

HAROLD N. AND ALMA L. MOLDENKE

FOREWORD

[The letter from Dr. Moldenke that accompanied the article on the *Verbenaceae* by the Moldenkes is of general interest, and the greater part of it is quoted below and will serve as a "foreword" to the contribution that follows. —*H. P. T.*]

In several of your letters to me you have indicated that you, too, are interested in the human aspects of botany. As the author of one of the passages which I quote in our paper points out, behind every scientific accomplishment stands a human personality. Too many scientists are so engrossed with the pure scientific aspects of their work that they forget the "human interest" elements; they forget the human personalities who have contributed of their life's blood in order to produce the scientific knowledge which we so glibly accept today as the basis upon which we build our own contributions. Dr. Rusby, in a quotation which we give in our paper, states that one of the chief aims of the study of any subject, including botany, is the improvement of human personality. I think we all too often forget this and think that the plants *per se* are the important features of our study. Actually they are not, but the improvement of human personality—our own, that of our colleagues, and that of future workers—is the prime aim. Thus, I feel that we should not neglect the human aspects of botany.

Pulteney, back in 1790, well said "In tracing the progress of human knowledge . . . . it is scarcely possible . . . not to feel an ardent wish of information relating to those persons by whom those improvements have severally been given: and hence arises that interesting sympathy which almost inseparably connects biography with the history of each respective branch of knowledge." Because we feel that this is very true, my wife and I have gone to great pains to assemble in our paper brief thumbnail biographic sketches of the 674 men and women whose contributions have been such or whose influence on workers in the group have been such that they have had genera, species, or varieties named in their honor. Never before has such a compilation been made for a plant family, as far as I am aware—certainly never before for the *Verbenaceae*. You have no idea of how difficult it has been to assemble even these very meager data! We have written over 200 letters, air mail, to various parts of the United States, Philippines, China, England, France, Germany, Belgium, Martinique, Netherlands, Australia, Brazil, Uruguay, Argentina, Colombia, Costa Rica, and even such remote places as the Seychelle Islands and Mauritius in search of data for these biographies! Many of the biographies which we give in our paper have apparently never been recorded in print before; many others can be

found only by experts searching in out-of-the-way records. The Research Department of the Library of Congress and of the New York Public Library have been most cooperative and helpful and have dug up some of the facts for us from very obscure sources—in some cases they have not yet succeeded in finding anything and are still on the search. In the case of missionaries who have collected plants in out-of-the-way corners of Africa, China, or Oceanica, we have contacted foreign mission boards not only in this country, but in England and Scotland and have had people searching through old mission records for information for us! There are 5 or 6 such missionaries about whom we still lack the essential data that we want—we are hoping that some of the letters to mission boards, registrars of colleges and universities, etc., which are still outstanding will bring in at least some of this information before time to go to press.

We feel that these brief biographic notes will be of interest and value not only to all persons working on the *Verbenaceae* and related groups now or in the future, but also to workers on all other groups (because the vast majority of these men and women who are the basis of biographic sketches herein have also contributed to many other families and groups) and, of course, to biographers and bibliographers. It may encourage monographers of other families, now and in the future, to compile similar material for their groups and thus—eventually—there may be preserved in botanical literature much biographic material which might otherwise be lost forever. As an example, let me cite the case of *Citharexylum Emrickianum*. We could find no information at all about the man "Emrick" for whom this species was named other than the fact that he had collected the type specimen in Mexico. Corresponding with Standley at the Chicago Museum revealed the interesting fact that he, too, has been interested for many years in finding out more about this collector, whose Mexican collections are in the Chicago Museum and are of extremely great value. Standley had been totally unsuccessful, like us, until suddenly, by accident, the very day that my letter to him on this subject reached him, he happened to glance over the death notices in a Chicago newspaper. There he found listed the death of a "Dr. Emrick." He at once telephoned the widow and found that the man who had just died was the son of the Emrick who had collected the plants in Mexico for Dr. Millspaugh at Field Museum. Had we found out about this son a few days earlier, we might have been able to get a full biography of the botanical collector! As it is, we have gotten some information about him and I now have letters in the mail to every "Emrick" listed in the Chicago telephone directory, in the hope that from some of these people I may be able to obtain more of the essential information about the botanist! If this is not done now it will be forever too late.

In our paper we have given a very large bibliography in the form of 170 explanatory notes and literature citations. These explanatory notes, taken all in all, comprise the largest bibliography of the *Verbenaceae* ever assembled, especially as many of the references cited

themselves contain smaller bibliographies, so that the total number of references to which a future worker would have access through our bibliography is far, far larger than the number of our footnotes—probably closer to 500 or 600. Also, we have made a special effort to document all the most important statements in our text. The photographs of pages dealing with verbenaceous plants in some of the oldest botanical books known will, we feel, be of special interest to the general reader who probably never has even seen one of those old herbals.

I think that the type of information we have put in our biographic sketches makes it more interesting reading to the general reader than if we had nothing but a long series of dates, positions held, etc., in the telegraphic fashion of a "Who's Who" sketch. We have tried to put in our sketches things of general human interest, emphasizing the cases where botanists have been murdered by hostile natives, cast adrift on the sea, fallen over cliffs to their death, died in airplane crashes, in one case eaten by a crocodile, in one case according to rumor eaten by cannibals. We have told of botanists caught in wars, held prisoner, dismissed from their posts because of having stated their opinions too frankly; botanists whom bad luck and misfortune followed all through life, whose plant collections were lost in shipwreck or hidden away and not "discovered" until many years later. I think that this is not "dry" reading and we hope that you will agree with us. [Editorial note.—readers should note that the story behind *Clerodendrum Thomsonae,* on which the cover design is based, was unearthed by the Moldenkes.]

PART I.

"Whenever one does decide to publish, it is necessary to reckon with the great 'paper memory of mankind,' the conserved experience of other workers who have loved and investigated the same things. It then becomes a duty to study the 'literature of the subject' . . . Failure to do this may be justly interpreted as carelessness, sloth, ignorance, or conceit."—W. M. Wheeler.[1*]

The concept of natural families in the plant kingdom is usually regarded as having originated with Bernard and Antoine Laurent de Jussieu. While it seems to be a fact that this concept actually did originate with them, it also seems to be true that they were not the first to formally publish their ideas so that their contemporaries and posterity might benefit thereby. Bernard de Jussieu, usually given the most credit for the origin of the "natural system," arranged the plantings of the Trianon gardens in natural groups or families and in 1759[2] prepared a list entitled "Order established by M. Bernard de Jussieu for the plants in the garden of Trianon." However, it seems that this list was never published and we know of it and of his ideas in general mostly from the preserved and published letters which he and his con-

* Exponential numbers refer to "Explanatory Notes and Literature Citations" at the end of the article.

temporaries wrote. Neither did Antoine Laurent de Jussieu formally publish his system until the year 1789. Necker in 1770 described[153] and named numerous natural groups or families, but did not include any corresponding to our present *Verbenaceae.* Thus, it would seem that the actual recorded history of the *Verbenaceae* as a family may be regarded as having begun with the much-maligned and unjustly treated genius, Michel Adanson, (1727—1806). In 1763 Adanson, in his classic "Familles des Plantes," formally published a classification of the plant kingdom into families for the first time in scientific history, although in this work he frequently gives credit to the Jussieus as the source of many of his ideas. These 58 families of Adanson, embracing a total of 1615 genera,[3] were far more natural groupings than the purely artificial classes of Linné's "sexual system," and, while the idea of such natural families seems elementary to us today, we must not forget that it was most radical and even revolutionary in Adanson's time. What a stupendous task it must have been to rearrange all the known genera from the comparatively simple and easy artificial classes of Linné into more natural family groupings! And it was a courageous undertaking, for it entailed bucking the authority and prestige of the great Linné, because while Linné at least twice published lists of genera according to natural orders, like the crucifers and umbellifers,[4] he seems to have looked upon this grouping as a kind of supernatural manifestation. He never actually put his natural classification into use and never even attempted to define his natural groups.[5] That Adanson and the other early systematists made mistakes in their groupings is to be expected. The amazing thing is that they managed as well as they did under the circumstances!

Adanson proposed[6] a family which he called *Verbenae* or "les vervènes," and he went even further than that. He divided the family into two sections. The first of these sections was characterized by him as "A fruit qui se sépare en 2 ou 4 graines." In this section he placed the genera *Alquelagen* Feuill.,[7] *Verbena* Tourn., *Kempfera* Houst., *Blairia* Houst., *Sherardia* Vaill., and *Lippia* Houst. His second section was characterized by him as "A fruit en Baye ou en Capsule" and included *Camara* Marcg., *Oftia* Adans., *Gmelina* L., *Cumbulu* Rheede, *Bontia* Plum., *Cornutia* Plum., *Clerodendron* Burm., *Vitex* Tourn., *Mailelou* Rheede, *Douglassia* Houst., *Citharexylon* Pluk., *Duranta* L., *Gerardia* Plum., *Schwalbea* Gron., *Petrea* Houst., *Hebenstretia* L., *Tozzia* Mich., *Vadakodi* Rheede, *Upata* Rheede, *Leptostachia* Mitch., *Michelia* Houst., and *Priva* Adans. It is most significant that of these 28 genera as recognized by Adanson only 11 are not admitted today as verbenaceous, viz., *Alguelagen (=Sphacele, Lamiaceae), Oftia (Myoporaceae), Cumbulu (=Catalpa, Bignoniaceae), Bontia (Myoporaceae), Schwalbea (Scrophulariaceae), Hebenstretia (Selaginaceae), Tozzia (Scrophulariaceae), Vadakodi (=Justicia, Acanthaceae), Upata (=Avicennia, Avicenniaceae), Michelia (=Pontederia, Pontederiaceae),* and *Leptostachia (=Phryma, Phrymaceae).*

Agnus castus schaffmulle Cap. liij.

AGnus castus vel salix marina vel arbor abrahe latine·grece Aligos vel lygos· arabice Amarikest· Serapio in dem buch aggregatoris in dem capitel amarikest id est agnus castus spricht daz diß sy ein baum abrahe·Disser baum wechset gern by dem wasser vnd hait lange stengel die synt gar hart vnd laißet sich vngern brechen· Disser baum brenget samen der glichet den

Page from the 1485 edition of "Hortus Sanitatis Deutsch," by Johann von Cube [= Johann Wonnecke], printed by Peter Schoffer in Mainz, showing a crude but recognizable illustration of **Vitex Agnus-castus** L.
Plate 3

Carl von Linné (1707—1778), generally regarded as the founder of the binomial system of nomenclature, was acquainted with 50 species and varieties of plants which we today classify in the *Verbenaceae*. In his justly famous and epochal "sexual system" of classification,[8] he grouped these in three classes. In his class DIANDRA MONOGYNIA he placed *Verbena*, of which he listed 14 species (only 5 of which are now regarded as true members of that genus). With *Verbena* in this class, however, were 23 other more or less unrelated genera such as *Chionanthus, Jasminum, Ligustrum, Nyctanthes, Olea, Phillyrea*, and *Syringa* of the present-day *Oleaceae, Eranthemum, Justicia*, and *Dianthera* of what we now call the *Acanthaceae, Pinguicula* and *Utricularia* of the *Lentibulariaceae, Morina* of the *Dipsacaceae, Circaea* of the *Oenotheraceae, Gratiola* and *Veronica* of the *Scrophulariaceae*, and *Amethystea, Collinsonia, Lycopus, Monarda, Rosmarinus, Salvia*, and *Zizyphora* of the *Lamiaceae*. In his class TETRANDRIA MONOGYNIA he placed the genera *Callicarpa*, with 2 species, and *Aegiphila, Siphonanthus*, and *Tomex*, each with a single species. In the same class were 48 other genera belonging to such diverse families as *Avicenniaceae* (1 genus), *Berberidaceae* (1), *Chenopodiaceae* (1), *Cornaceae* (1), *Dipsacaceae* (3), *Elaeagnaceae* (1), *Ericaceae* (1), *Gentianaceae* (1), *Globulariaceae* (1), *Loganiaceae* (2), *Loranthaceae* (1), *Lythraceae* (1), *Moraceae* (1), *Oenotheraceae* (2), *Penaeaceae* (1), *Phytolaccaceae* (1), *Plantaginaceae* (1), *Primulaceae* (1), *Proteaceae* (3), *Rosaceae* (2), *Rubiaceae* (16), *Rutaceae* (1), *Salvadoraceae* (1), *Scrophulariaceae* (1), *Trapaceae* (1), and *Vitaceae* (1). In his class DIDYNAMIA ANGIOSPERMA Linné placed *Citharexylum, Clerodendrum, Cornutia, Duranta, Gmelina, Lantana, Lippia, Ovieda, Petrea, Premna, Vitex*, and *Volkameria*—all with one species each except *Duranta, Premna*, and *Volkameria* with 2 each, *Vitex* with 4 and 1 variety, and *Lantana* with 7 and 3 varieties. In this same class, however, he placed 45 other genera representing such diverse groups as *Acanthaceae* (3 genera), *Bignoniaceae* (2), *Caprifoliaceae* (1), *Gentianaceae* (1), *Gesneriaceae* (3), *Martyniaceae* (1), *Melianthaceae* (1), *Myoporaceae* (1), *Orobanchaceae* (3), *Pedaliaceae* (2), *Polemoniaceae* (1), *Scrophulariaceae* (23), *Selaginaceae* (2), and *Solanaceae* (1), In view of this amazing assemblage of genera the feat of Adanson in culling out the genera which he placed in his family *Verbenae* begins to take on its true proportions.

Next in the history of the family must be mentioned Antoine Laurent de Jussieu (1748—1836), who, in 1789,[9] proposed a series of "natural orders," a term which was to persist long after his time and was even used up to and including the sixth edition of Asa Gray's "Manual."[10] Among Jussieu's "natural orders" was one which he called *Vitices* or "les gattiliers" and which he subdivided into 3 sections: "I. Flores oppositi corymbosi," including *Clerodendrum* L., *Volkameria* L., *Aegiphila* L.,*Vitex* Tourn., *Callicarpa* L., *Manabea* Aubl., *Premna* L., *Petitia* Jacq., *Cornutia* Plum., *Gmelina* L., *Theka* Rheede, and *Avicennia* L.; "II. Flores spicati, in spicis alterni," including *Petraea* L., *Citharexylum* L., *Duranta* L., *Lippia* L., *Lantana* L., *Spielmannia* Medic., *Taligalea* Aubl., *Tamonea* Aubl., *Verbena* Tourn., and *Perama* Aubl.; and "III. Genera Viticibus affinis," consisting of *Eranthemum* L., *Selago* L., and *Hebenstretia* L. All Jussieu's genera are verbenaceous except six: *Spielmannia*

ni imperij cõditoribus q̃ immẽsum quiddã dedit. Non aliunde ſagmina in remedijs publicis, & in ſacris legationibus uerbenæ, q̃ ex hac genti illi fuere: qua coronati ad hoſtes fœciales mitterẽtur: ideo q̃ ſacra herba uulgo dicta & cognita. Romani uerbenacã, q̃ ſola & per ſe uerbenas faceret, dixerũt: gẽtium iura & publicæ utilitatis cauſam ſecuti. Græci quibus nulli fœciales erãt, nec idem in legatis ritus, naturã contẽplati, periſtereona nominauerũt, à colũbis, ut hic ait, facto nomine: q̃ hęc auis libenter inter eam uerſetur. Vtraq; gens duo eius cognouit genera, diuerſis tamen notis ea diſcreuerunt, Latini à ſexu marem & fœminam: Græci à plantæ habitu, rectam & ſupinam dicentes. Addiderunt per tẽpora & ex alijs cauſis alias aliæ gentes appellationes. Romani etiã criſtam gallinaceam dicere potuerunt, q̃ folia illi ſerrata ſint, qualis in ea aue criſtatus apex ille eſt. Sic etiã herbam ſagminalẽ: q̃ inter ſagmina primũ hæc honorem haberet. Relinquimus quid ſagmina ſint docere, quia uerbenæ etiã: quoniã in Latina re iampridẽ oĩbus hæc nota ſunt. Habuit & alias in poſterioribus Latinis appellationes uerbenaca, quarũ numerauit aliquas Apuleius in cõmentariolo illo de herbis: numerauerũt & alij: quę quoniã à Barbaro repetitę lõgius in Corollario ſuo ſunt, à nobis relinquuntur. Multæ laudis & magni nominum ambitus herba hæc ſemper fuit: multis q̃ locis religione conſecrata: quod raro factum hiſtoria & experientia oſtendit in his, quæ natura omnibus cõmunia fecit: qualis uerbenaca hæc recta eſt, nullis non fere locis naſcẽs, & ruſticæ plebi ubiq; nota.

De Verbenaca ſupina. Cap. LIX.

PEriſtereona ſupinum. Sunt qui & hanc ſacrã herbã nominent, ⌊ qui erigẽnion, qui chamæleucon, qui ſideritim, qui Curitim, qui Perſephonion, qui Iouis colum, qui dichromon, qui calleſin, qui cipariſſon, qui Demetriada appellẽt. Aegyptij pemphtemphtham. Pythagoras eryſiſceptrum. Romani cincinnalẽ herbam dicunt. ⌊ Cubitales uerbenaca hæc profert uirgas, aliquando etiam maiores & anguloſas. Circa quas folia ſunt per interualla quernis ſimilia: anguſtiora tamen minoraq; ſed per ambitum ſecta: colore quadantenus glauco. Radicem habet oblõgam gracilemq;: Flores purpureos tenuesq;. Aduerſantur ſerpentibus folia huius uerbenacæ: in quem uſum bibenda dantur, aut emplaſtrimodo imponuntur Bibuntur cõtra fellis ſuffuſiones eadem folia utiliter drachmæ pondere cum thuris obolis tribus, & uini ueteris hemina una ieiunis quadraginta diebus. Quinetiam ueteres tumores & inflammationes leniunt emplaſtri modo impoſita: & ſordida purgant ulcera. Ipſa etiam tota herba cum uino tonſillarum cruſtas erũpit, & oris depaſcẽtia ulcera gargariſſata compeſcit. Fertur triclinijs inſperſum uerbenacæ dilutum, leniores conuiuas facere. Datur contra tertianas bibendus cum adiacentibus folijs tertius à terra geniculus eius: cõtra quartanas uero, quartus. Sacra herbã uerbenacã ideo uocant, quoniã fœlicẽ habeat uſum in luſtrationibus ſuſpẽſa alligata ue.

πρὶ ἱροβοτάνης. κεφ. χμγ'.

ἱερὰ βοτάνη. οἱ δέ, πεντεδρεῶνα. οἱ δέ, ἡμιγλώσιον. οἱ δὲ, χαμαίλυκον. οἱ δέ, σιδηρῖτιν. οἱ δὲ, κουζίζαν. οἱ δὲ, φερεφόνιον. οἱ δὲ, διὸς ἡλακάτην. οἱ δὲ, δίχωμον. οἱ δὲ, κάλλιστιν. οἱ δέ, ἱππάριστον. οἱ δέ, δημητριάδα. αἰγύπτιοι πεμφθενφθάν. πυθαγόρας ἐρυσίσκηπτρον. ῥωμαῖοι κιγκινάλλιδα. ⌊ ἐκάλεσαν. ῥάβδους ἀνίστησι πηχυαίους ἢ μείζονας γωνιωδεῖς. πρὸς δὲ τὰς τὰ φύλλα ἐκ διασκημάτων ἐοικότα δρυΐ. πλὴν σφόδρα ἕτερα ἤπονα. ὡς τετμημένα δέ. τὰ κύκλῳ ὑπόγλαυκα. ῥίζαν δὲ ὑπομήκη. λεπτήν. ἄνθη πορφυρᾶ. λεπτά. ταύτης τὰ φύλλα καὶ ἡ ῥίζα πρὸς ὄφεων φάρμακα μετ' οἴνου καταπλασσόμενα, πρὸς πρὸς ἕρπετά. πρὸς δὲ ἴκτερον τὰ φύλλα ὅσον ⊲ ὁλκὴν μετὰ λιβανωτοῦ ἑκτεβόλου, σὺν οἴνου παλαιοῦ κοτύλῃ μιᾷ νήστει ἐφ' ἡμέρας μ'. πινόμενα. οἰδήματά τε χρόνια καὶ φλεγμονὰς καταπλασθέντα πραΰνει. καὶ ξυπτὰ ἕλκη καθαίρει ἐψηθέντα δὲ ὅλη σὺν οἴνῳ, ἐχάρας τὰς ἐν πρωκτῷ πρηκτῆ. νομὰς τὰς ἐν στόμασι ἀναγαργαριζομένη ἐφίστησι. ἁλουόμενόν τε ἐν συμποσίοις τὸ ἀπόβρεγμα, εὐδιαπωτοτέρους ἴσορρῆ πρήθει. δίδοτη δὲ ἕως τριῶν ἐπὶ τὸ τρίτον γόνυ ἀπὸ τῆς γῆς σὺν τοῖς προκειμένοις φύλλοις. τετάρταιζουσι δὲ τὸ τέταρτον. καλοῦσι δὲ αὐτὴν ἱερὰν βοτάνην διὰ τὸ εὔχρηστον ἐν τοῖς καθάρμοις εἶναι εἰς πρόμματα.

πρὶ ἱροβοτάνης. κεφ. χμγ'.

ἱερὰ βοτάνη. οἱ δέ, πεντεδρεῶνα. οἱ δέ, ἡμιγλώσιον. οἱ δὲ, χαμαίλυκον. οἱ δέ, σιδηρῖτιν. οἱ δὲ, κουζίζαν. οἱ δὲ, φερεφόνιον. οἱ δὲ, διὸς ἡλακάτην. οἱ δὲ, δίχωμον. οἱ δὲ, κάλλιστιν. οἱ δέ, ἱππάριστον. οἱ δέ, δημητριάδα. αἰγύπτιοι πεμφθενφθάν. πυθαγόρας ἐρυσίσκηπτρον. ῥωμαῖοι κιγκινάλλιδα. ⌊ ἐκάλεσαν. ῥάβδους ἀνίστησι πηχυαίους ἢ μείζονας γωνιωδεῖς. πρὸς δὲ τὰς τὰ φύλλα ἐκ διασκημάτων ἐοικότα δρυΐ. πλὴν σφόδρα ἕτερα ἤπονα. ὡς τετμημένα δέ. τὰ κύκλῳ ὑπόγλαυκα. ῥίζαν δὲ ὑπομήκη. λεπτήν. ἄνθη πορφυρᾶ. λεπτά. ταύτης τὰ φύλλα καὶ ἡ ῥίζα πρὸς ὄφεων φάρμακα μετ' οἴνου καταπλασσόμενα, πρὸς πρὸς ἕρπετά. πρὸς δὲ ἴκτερον τὰ φύλλα ὅσον ⊲ ὁλκὴν μετὰ λιβανωτοῦ ἑκτεβόλου, σὺν οἴνου παλαιοῦ κοτύλῃ μιᾷ νήστει ἐφ' ἡμέρας μ'. πινόμενα. οἰδήματά τε χρόνια καὶ φλεγμονὰς καταπλασθέντα πραΰνει. καὶ ξυπτὰ ἕλκη καθαίρει ἐψηθέντα δὲ ὅλη σὺν οἴνῳ, ἐχάρας τὰς ἐν πρωκτῷ πρηκτῆ. νομὰς τὰς ἐν στόμασι ἀναγαργαριζομένη ἐφίστησι. ἁλουόμενόν τε ἐν συμποσίοις τὸ ἀπόβρεγμα, εὐδιαπωτοτέρους ἴσορρῆ πρήθει. δίδοτη δὲ ἕως τριῶν ἐπὶ τὸ τρίτον γόνυ ἀπὸ τῆς γῆς σὺν τοῖς προκειμένοις φύλλοις. τετάρταιζουσι δὲ τὸ τέταρτον. καλοῦσι δὲ αὐτὴν ἱερὰν βοτάνην διὰ τὸ εὔχρηστον ἐν τοῖς καθάρμοις εἶναι εἰς πρόμματα.

INTERPRES.

SVperiorem uerbenacam Græci, q̃ recto caule riget, rectam: hanc, q̃ deiectis in terrã ramulis quaſi ſacet, ſupinã uocauerũt. Nec ſolũ inter eas hoc diſcrimen obſeruatũ ab illis eſt, ſed ut ex utriuſq; hiſtoria licet cognoſcere, plura alia ſunt, quibus inter ſe diſconueniãt. præſertim q̃ numerus & lõgitudo ramulorũ. Quod idem ambabus eſt, & quod cognomines eas fecit, ſolierũ figura, & in folijs pares inciſuræ ſunt. Vidimus nos quã nunc rectã uerbenacã dicunt, multo maiore altitudine q̃ dodrantali: Contra q̃ ſupinã longe breuioribus q̃ cubitalibus uirgis: & in utraq; quod in ſcriptore hoc nõ legitur, quadrangulis ramulis: Rectam itidem ſingulari caule, ſed non ſingulari radice: niſi hic unam eius radicem forte dixerit, quæ craſſior alijs eſt: cæteras uero fibras & capillamenta magis q̃ radices eſſe uoluerit. In utraq; autem, quod paulo ante diximus, eadem ſerrata & quernis ſimilia folia ſunt. Viſæ q̃ nobis plantæ hæ ſunt magis ad Plinij q̃ adſcriptoris huius picturam accedere. Fuerunt quondam, ut Plinius idem teſtatur, &, ut licet ex tam multis nominibus quæ in ſcriptore hoc legũt cõijcere, magis in magno honore uerbenaq: qui omnia ad ſuſpẽdos

uana

Page from the 1529 edition of "De Medica Materia Libri V" by Dioskorides Pedanios on which a description appears of what is now called **Verbena supina** L.
Plate 4

(Myoporaceae), Perama (Rubiaceae), Eranthemum (Acanthaceae), Avicennia (Avicenniaceae), Selago (Selaginaceae), and *Hebenstretia (Selaginaceae).*

In 1790 Necker (1730—1793) proposed[11] a unique classification of the plant kingdom into a few artificially-characterized groups reminiscent of the sexual classes of Linné. In his CORYTOPHYTUM he included *Verbena, Abena, Patya,* and *Denisaea,* along with 46 other genera, of which 44 are now regarded as belonging in the *Lamiaceae,* 1 belongs in the *Convolvulaceae,* and the 46th was *Phryma* of the *Phrymaceae.* In his CHASMOPHYTUM he included *Geunsia, Aubletia, Cornutia, Vitex, Tamonea,* and *Gmelina,* as well as *Avicennia* of the *Avicenniaceae, Bontia* of the *Myoporaceae, "Hebenstreitia"* of the *Selaginaceae,* and 40 other genera of which 28 are now placed in the *Scrophulariaceae,* 5 in the *Acanthaceae,* 2 each in the *Utriculariaceae, Orobanchaceae,* and *Gesneriaceae,* and 1 in the *Rutaceae.* In his PLASYRGOPHYTUM he placed *Citharexylum, Duranta, Ovieda, Amasonia, Lippia, Diphystema, Lantana, Volkameria, "Clerodendron," "Petraea,"* and *Premna,* as well as *"Spielmania"* of the *Myoporaceae, Selago* of the *Selaginaceae,* and 35 other genera, of which 12 are now placed in the *Scrophulariaceae,* 5 in the *Acanthaceae,* 3 each in the *Pedaliaceae, Solanaceae,* and *Bignoniaceae,* 2 each in the *Gentianaceae* and *Gesneriaceae,* and 1 each in the *Caprifoliaceae, Martyniaceae, Loganiaceae, Orobanchaceae,* and *Polemoniaceae.*

Four years later, in 1794, E. P. Ventenat (1757—1808) first proposed[12] for the group a name which had the *-aceae* termination now taken as indicative of plant family names. Ventenat's name for the group was *Pyrenaceae.* This name, however, was a descriptive one, referring to the fruits or "pyrenes" produced by most of the genera. Because it was not derived from a typical generic name, with the suffix *-aceae* appended to the stem of the generic name, it is not maintained today even though it is the oldest. Ventenat divided the family into 4 sections, characterized as follows: 1, "Fleurs disposées en corymbe. Péricarpe charnu," including *Clerodendrum, Ovieda, Volkameria, Aegiphila, Callicarpa, Vitex, Cornutia,* and *Gmelina;* 2, " Fleurs disposées en épi Péricarpe charnu," including *Citharexylum, Duranta, Lantana,* and *Spielmannia;* 3, "Fleurs en épi. Semences nues," including *Verbena* and *Zapania;* and 4, "Genres qui ont de l'affinité avec des Pyrénacées," comprising *Selago* and *Hebenstretia.* Ventenat, thus, out of the 16 genera listed included only 3 not now regarded as verbenaceous: *Spielmannia, Selago,* and *Hebenstretia.*

It was J. H. Jaume Saint-Hilaire (1772—1845) who, in 1805, first proposed[13] the name which is now used for the family, *Verbenaceae,* founded on the large and typical genus *Verbena.* Jaume Saint-Hilaire divided the family into 3 sections: 1, "Fleurs opposées sur un corymbe rameux," including *Clerodendrum, Volkameria, Ovieda, Aegiphila, Vitex, Callicarpa, Manabea, Premna, Petitia, Cornutia, Gmelina, Theka,* and *Avicennia;* 2, "Fleurs disposées en épis alternes," including *"Petraea," Citharexylum, Duranta, Lippia, Lantana, Spielmannia, Zapania, Verbena, Taligalea, Tamonea,* and *Perama;* and 3, "Genres qui ont de l'affinité avec les Verbénacées," comprising *Eranthemum, Selago,* and *Hebenstretia.* Out of the 27 genera Jaume Saint-Hilaire included, thus, only

6 which are not truly verbenaceous—the same 6 of Jussieu: *Spielmannia, Perama, Avicennia, Eranthemum, Selago,* and *Hebenstretia.*

From this time on, the family has been almost universally known as the *Verbenaceae,* although Jussieu is usually credited with being the author, and the reference quoted in book after book, by writers[14,15,16,17,18] who apparently never took the trouble to look it up, is "Ann. Mus. Paris 7: 63—77. 1806." Actually in this 1806 work Jussieu never used the name accredited to him, but referred to the group (of 28 genera, including *Spielmannia* and *Perama)* only as "les Verbénacées."

The name *Verbaceae* is sometimes listed[19] and accredited to H. F. Link (1767—1851) in his enumeration of the plants of the Berlin botanical garden,[20] but this was merely a typographic error for "*Verbenaceae*" as can be seen from the use of the latter spelling in a later part of the same volume. The same is true of "*Berbenaceae*" sometimes found in Spanish language works[21] and the "*Vervenaceae*" of De Wildeman.[22] It is worthy of note that Link still included *Selago* and "*Hebenstreitia*" in the *Verbenaceae.*

Robert Sweet (1783—1835) in 1826 accredits[23] the name *Verbenaceae* to Brown. He includes 30 genera in the family: *Clerodendrum, Volkameria, Aegiphila, Callicarpa, Vitex, Wallrothia, Chloanthes, Premna, Holmskioldia, "Petraea," Hosta, Cornutia, Gmelina, Citharexylum, Duranta, Amasonia, Lantana, Tectona, "Colebrookia," Streptium, Priva, Tamonea, Stachytarpheta, Zapania, Aloysia, Verbena, Lippia,* and the non-verbenaceous *Spielmannia, "Hebenstreitia,"* and *Selago.*

From the very first we see that attempts were made to subdivide the family. Adanson divided it into two sections based on the character of the fruit. Jussieu, Ventenat, and Jaume Saint-Hilaire had certain genera which they regarded as true members of the family and other genera which were appended as merely related to it with their exact position in doubt. Jussieu and Jaume Saint-Hilaire recognized two sections among the true members of the family, characterized by either determinate or indeterminate inflorescences. It is most significant that this same character is still used today as forming the main division in the family. Ventenat recognized three sections, characterized by the same inflorescence characters plus fruit and seed characters. None of these workers bothered to give formal scientific names to their sections.

In 1829 B. C. J. Dumortier (1797—1878) made the first definite segregation[15] within the family into formally named tribes:

Tribe 1. *Verbeneae* Dumort. "Bractéoles alternes."

Tribe 2. *Viticeae* Dumort. "Bractéoles opposées."

In the first of these tribes he placed the genera *Verbena, Zapania, Aloysia, Stachytarpheta, Chloanthes, "Petraea," Citharexylum, Duranta, Priva, Lippia, Lantana,* and "*Spielmania.*" In the second tribe he included "*Clerodendron,*" *Volkameria, Siphonanthus, Vitex, "Holmskidia," Aegiphila, Callicarpa, "Permna," Hosta, "Cornutea," Gmelina,* and *Tectona.* He classified *Avicennia* in his family "*Myoporineae* R. Br." along with the genera *Myoporum, Stenochilus,* and *Bontia.*

F. G. Bartling (1798—1875) in 1830[16] and J. Lindley (1799—1865) in 1836[18] followed Dumortier in the characterization of two divisions in the family, although Bartling called them Section 1, *Viticea* Bartl., and Section 2, *Verbenae* Bartl., while Lindley called them "*Viticeae* Bartl." and "*Verbeneae* Bartl."

Beginning with S. Endlicher (1804—1849), the classification of the *Verbenaceae* becomes continually more complicated, detailed, and accurate, conditions concomitant with the continued discovery and description of new genera and species throughout the world. Endlicher in 1838 recognized[24] three tribes definitely within the family—Tribe 1, *Lippieae* Endl.; Tribe 2, *Lantaneae* Endl.; and Tribe 3, *Aegiphileae* Endl.—and, in addition, appended *Avicennia* as an unnumbered tribe, *Avicennieae* Endl., merely related to the *Verbenaceae.* Here, then, is the second recognition that *Avicennia* does not belong in the true *Verbenaceae.*

C. F. Meissner (1800—1874) in 1839 increased[25] the number of tribes to five:

Tribe 1. *Lippieae* Endl.
Tribe 2. *Lantaneae* Endl.
Tribe 3. *Symphoremeae* Meissn.
Tribe 4. *Aegiphileae* Endl.
Tribe 5. *Avicennieae* Endl.

The first treatment of the family that can be called truly monographic in the modern sense of that word, wherein an attempt is made not only to list and describe all the genera, but also all the known species and varieties throughout the world and account for all names published in the group, was that of W. G. Walpers (1816—1853) in 1844—1847. Walpers' treatment[26] is, therefore, of considerable interest. He divided the family into five tribes and recognized 52 genera, 715 species, and 38 varieties. He also excluded 3 genera and 30 binomials and appended 4 genera as probably but not certainly verbenaceous. His classification may be presented as follows:

Tribe 1. *Lippieae* Endl.—including *Caryopteris* (1 species), *Mastacanthus* (1), *Peronema* (1), *Stachytarpheta* (41 spp. & 1 var.), "*Bouchéa*" (3), *Shuttleworthia* (7), *Verbena* (111 spp. & 13 vars.), *Priva* (10), *Phryma* (1), *Monochilus* (1), *Quoya* (1), *Dipyrena* (1), *Chascanum* (7), *Casselia* (4), *Aloysia* (9), *Lippia* (67 spp. & 4 vars.), *Cryptocalyx* (1), *Buchia* (1), and *Chloanthes* (6).

Tribe 2. *Lantaneae* Endl.—including *Spielmannia* (2), *Lantana* (63 spp. & 4 vars.), "*Petraea*" (11 spp. & 2 vars.), *Petitia* (2), *Mallophora* (2), "*Citharexylon*" (38 spp. & 1 var.), *Duranta* (13), *Hosta* (5), *Pyrostoma* (1), *Wallrothia* (2), *Vitex* (55 spp. & 3 vars.), *Viticastrum* (1), *Calochlamys* (1), *Casarettoa* (2), *Premna* (30), *Holochiloma* (1), *Pityrodia* (1), *Gmelina* (7), "*Tectonia*" (2), *Hemigymnia* (1), *Volkameria* (7), *Cyclonema* (4), "*Clerodendron*" (84 spp. & 2 vars.), *Tamonea* (3 spp. & 1 var.), and *Geunsia* (1).

Tribe 3. *Symphoremeae* Meissn.—including *Symphorema* (2) and *Congea* (8).

Tribe 4. *Aegiphileae* Endl.—including *Scleroon* (1), *Aegiphila* (39), *Amasonia* (5), *Cornutia* (1), and *Callicarpa* (37).
Tribe 5, *Avicennieae* "Meissn."—including *Avicennia* (2 spp. & 7 vars.).
"Genera incertae sedis et non satis nota"—including *Hymenopyramis* (1), *Glossocarya* (1), *Analectris* (1), and *Cochranea* (1).

The genus *Spartothamnus* was placed by Walpers in his "order" *Myoporineae*. On the other hand, it is worthy of note that he still included in the *Verbenaceae* the genera *Phryma, Spielmannia, Hemigymnia, Cochranea, Avicennia, Symphorema,* and *Congea,* now regarded as not verbenaceous.

The second treatment of the *Verbenaceae* which can be described as truly monographic was that of J. C. Schauer (1813—1848) in 1847.[27] In fact, this work and Walpers' have been the only monographic treatments of the entire family ever published. Schauer's treatment is, therefore, also of extreme importance. Somewhat more conservative than Walpers, he recognized only 42 genera, 670 species, and 42 varieties, and excluded from the family 24 binomials previously included. A. de Candolle, writing in the same volume, recognized the *Myoporaceae* as a distinct family, but placed in it the verbenaceous genera *Nesogenes, Dasymalla*, and *Spartothamnus*. Schauer's treatment may be summarized as follows:

Tribe 1. *Verbeneae* Dumort.
Subtribe 1. *Spielmannieae* Schau.—including only *Spielmannia.*
Subtribe 2. *Monochileae* Schau.—including only *Monochilus.*
Subtribe 3. *Casselieae* Schau.—including *Casselia* and *Tamonea.*
Subtribe 4. *Verbeneae* (Bartl.) Schau.—including *Mallophora, Chloanthes, Priva, Dipyrena, Verbena, Bouchea, "Stachytarpha,"* and *Lippia.*
Subtribe 5. *Lantaneae* (Endl.) Schau.—including only *Lantana.*
Subtribe 6. *Duranteae* Schau.—including *Citharexylum* and *Duranta.*
Subtribe 7. *Petreae* Schau.[28]—including only *Petrea.*

Tribe 2. *Viteae* Schau.
Subtribe 8. *Symphoremeae* (Meissn.) Schau.—including *Symphorema, "Sphaenodesma,"* and *Congea.*
Subtribe 9. *Caryopterideae* Schau.—including *Caryopteris, Glossocarya, Hymenopyramis,* and *Peronema.*
Subtribe 10. *Viticeae* (Bartl.) Schau.—including *Pityrodia, Tectona, Premna, Petitia, Callicarpa, Aegiphila, Volkameria, Clerodendrum, Cyclonema, Oxera, Amasonia, Gmelina, Cornutia, Vitex, Holmskioldia, Quoya, Hemigymnia,* and *Scleroon.*

Tribe 3. *Avicennieae* Endl.—including only *Avicennia.*

Of great interest because of the fact that it is still adopted in certain quarters, is the classification of G. Bentham (1800—1884), proposed in 1876.[29] Among other things, Bentham harks back to Adanson and Wal-

pers in the inclusion of *Phryma* in the *Verbenaceae*. Bentham's system was essentially as follows:

Tribe 1. *Phrymeae* Benth.—including only *Phryma*.
Tribe 2. *Stilbeae* Benth.—including *Campylostachys, Stilbe, Euthystachys*, and *Eurylobium*.
Tribe 3. *Chloantheae* Benth.—including *Lachnostachys, Newcastlia, Physopsis, Mallophora, "Dicrastyles," Chloanthes, Pityrodia, Cyanostegia, Denisonia, Spartothamnus*, and *Nesogenes*.
Tribe 4. *Verbeneae* Dumort.—including *Acharitea, Lantana, Lippia, Baillonia, Neosparton, Bouchea, Stachytarpheta, Priva, Dipyrena, Verbena, Tamonea, Monochilus, Amasonia, Espadaea, Casselia, "Petraea," Citharexylum, Rhaphithamnus*, and *Duranta*.
Tribe 5. *Viticeae* (Bartl.) Benth.—including *Geunsia, Callicarpa, Aegiphila, Petitia, Tectona, Rapinia, Premna, Adelosa, Cornutia, Gmelina, Vitex, Faradaya, Oxera, "Clerodendron." Holmskioldia*, and *Teucridium*.
Tribe 6. *Caryopterideae* (Schau.) Benth.—including *Caryopteris, Glossocarya, Hymenopyramis*, and *Peronema*.
Tribe 7. *Symphoremeae* Meissn.—including *Symphorema, "Sphenodesma,"* and *Congea*.
Tribe 8. *Avicennieae* Endl.—including only *Avicennia*.

Widely accepted today is the detailed and scholarly classification of J. Briquet (1870—1931), proposed in 1895[30] and followed almost without question until only a few years ago. Although his treatment is not strictly monographic because it does not attempt to list, describe, and differentiate all the species in each genus, Briquet's work represents the culmination of almost 150 years of research and investigation in the group and is a vast storehouse of tremendously important and systematically arranged information. It and the monographs of Walpers and Schauer are the three most important works on the group extant. While Briquet did not list all the species, he did give careful estimates of the number of valid species in each genus and on the basis of these estimates it appears that in 1895 he regarded the family as containing 67 genera and 762 species. Comparing this figure with the 17 genera and 50 species and varieties known to Linné we may arrive at a fair approximation of the rate of increase in our knowledge of the group during the first 150 years of its history. Briquet's classification is as follows:

Subfamily 1. *Stilboideae* Briq.
Subfamily 2. *Verbenoideae* Briq.
  Tribe 1. *Euverbeneae* Briq.
  Tribe 2. *Lantaneae* Endl.
  Tribe 3. *Priveae* Briq.
  Tribe 4. *Monochileae* (Schau.) Briq.
  Tribe 5. *Petraeeae* Briq.
  Tribe 6. *Citharexyleae* Briq.
Subfamily 3. *Chloanthoideae* Briq.
  Tribe 7. *Achariteae* Briq.
  Tribe 8. *Chloantheae* Benth.

Habet Lugdunenſis pag. 1271. lib. 11. cap. 32. ramum Conſolidæ Sarracenicę maioris, non tamen puto diuerſam ab hac noſtra.

IV.

Virga aurea anguſtifolia ſerrata.

Solidago Saracenica Trago pag. 487. lib. 1. cap. 164. & Lob. obſ. pag. 159. & icon. pag. 299.

Huius adhuc ſpecies longioribus folijs.

SECTIO QVARTA.

VERBENA: SCABIOSA: IACEA: STOEbe: Succiſa: Cyanus: Tragopogon: Scorzonera: Caltha: Helenium: Flos Solis.

VERBENA.

ΕΡΙΣΤΕΡΕΩΝ, id eſt colũbaris, quòd circa hanc columbæ, perquàm libenter verſari ſoleant, Dioſcoride autore lib. 4. cap. 60. At Dioſcorides fortè Marrubium paluſtre vt ſuprà monuimus intellexit: Plinio lib. 25. cap. 9. Hierabotane (id eſt Sacra herba, quia in ſacris vtebantur) aliqui περιστερεῶνα noſtram Verbenacam vocant.

Genera duo Plinio, folioſa quam fœminam putant; mas rarioribus folijs.

I.

Verbena communis.

Verbena maſcula Brũſel. fol. pag. 119. Tom. 1. Rhapſ. 18. Et Hierabotane mas Eidem 4. pag. 105.

Verbenaca Matth. fol. lat. pag. 667. lib. 4. cap. 55. & ic. 4. pag. 713.

Verbena Dioſcoridis Lob. obſ. pag. 289. & communis Verbena, & Sacra recta Eidem icon. pag. 534.

Flores cærulei aut albidi.

Page from "Icones Plantarum aliquot Hactenus non Sculptarum," by Gaspard Bauhin, published in 1596, showing his discussion of what we now call **Verbena officinalis** L.
Plate 5

Tribe 9. *Physopsideae* Briq.
Subfamily 4. *Viticoideae* Briq.
Tribe 10. *Callicarpeae* Briq.
Tribe 11. *Tectoneae* Briq.
Tribe 12. *Viticeae* (Bartl.) Benth.
Tribe 13. *Clerodendreae* Briq.
Subfamily 5. *Caryopteridoideae* Briq.
Subfamily 6. *Symphoremoideae* Briq.
Subfamily 7. *Avicennioideae* Briq.

Recently there has been published a very provocative treatment by Sven Junell in which (1934)[31] revolutionary changes in the systematics of the *Verbenaceae* and related families are proposed. In brief, it may be stated that Junell's investigations of the gynoecium morphology of the *Lamiales* have convinced him that only Briquet's Subfamily 2 is truly verbenaceous. Junell would segregate Briquet's Subfamily 1 as the *Stilbaceae* and would shift his Subfamilies 3, 4, 5, 6, and 7 into the *Lamiaceae.* The genera *Acharitea, Nesogenes,* and *Cyclocheilon* he would exclude completely from the *Lamiales,* but he does not suggest where they actually should be classified. Our own studies of the group do not permit us to go quite as far as Junell, although we agree with him on the segregation of the *Stilbaceae* and would also segregate certain other families.

Thus, reviewing the checkered history of the *Verbenaceae* over the past 200 years, we find that a great many diverse groups of plants have been included in this family by various authors from time to time. Gradually, as our knowledge of these groups increased, they were, one by one, eliminated; some to be segregated as separate and coordinate families. If the type genus of a given family was at one time regarded as a member of the *Verbenaceae,* it can with justification be claimed that that family has been segregated from the *Verbenaceae.* Schrader in 1820[32] proposed the family *Ehretiaceae,* and Dumortier in 1829[33] proposed the family *Cordiaceae,* for the genera *Cordia, Ehretia, Hemigymnia,* and *Patagonula,* included in the *Verbenaceae* by various authors—*Cordia* and *Ehretia* by De Wildeman[34], *Hemigymnia* by Walpers[35] and Schauer[27], and *Patagonula* by De Candolle[36].

Next to be segregated were the *Selaginaceae*[37] and *Stilbaceae*[38] by Lindley in 1836. In the *Selaginaceae* are placed the genera *Hebenstretia* and *Selago,* included in the *Verbenaceae* by Jussieu, Ventenat, Sweet, Link, and Jaume Saint-Hilaire, and the first also by Adanson. In the *Stilbaceae* we have the genera *Campylostachys, Eurylobium, Stilbe, Euthystachys,* and *Xeroplana,* some or all of which were placed in the *Verbenaceae* by Bentham and Briquet. The name *Stilbinaceae* was proposed for this same family by Möbius in 1902[39] and is accepted by Junell.

In 1843 Horaninov segregated the *Bontiaceae*[40], typified by the genus *Bontia* which was originally included in what is now the *Verbenaceae* by Adanson. An older name for this family, however, is *Myopor-*

aceae, proposed by Lindley in 1836 [37]. In this family also belongs the genus *Spielmannia,* included in the *Verbenaceae* by Jussieu, Ventenat, Reichenbach, and Jaume Saint-Hilaire, and the genus *Oftia* included by Adanson.

Schauer in 1847 [41] delimited a new family, which he called *Phrymaceae,* to contain the peculiar genus *Phryma* (including *Leptostachia* of Adanson) of eastern North America and eastern Asia, included in the *Verbenaceae* by Adanson, Walpers, Bentham, Franchet [42], and Barnhart [19].

The genus *Avicennia* (including *Upata* of Adanson) has always presented a problem to systematists. Endlicher in 1838 [24] erected for it a special "order" (i.e., family) which he called the *Avicennieae* and which he described as "Verbenaceis affines." The *Stilbineae* were also kept separate by him as a distinct "order." In 1843 he formally proposed [43] the name *Avicenniaceae* for the black-mangrove family, in which he has been followed by Small in 1913 and 1933 [44], by Record in 1934 [45], and by Erdtman in 1945 [46]. In 1898 Van Tieghem published [47] extensive and detailed studies of *Avicennia* and proposed family status as "les Avicenniacées," and, in fact, went so far as to erect a separate order (in the modern sense of this word), the *Avicenniales,* including "les Hermandiacées," "les Avicenniacées," and "les Symphoremacées." In 1902 Möbius maintained [39] that the *Myoporaceae* is to be united with the *Verbenaceae* OR (!) with the *Scrophulariaceae,* and says that "*Avicennia* schlieszt sich hier an." In Potter's 1920 translation [48] the "family" *Nuculiferae* includes the "orders" *Cordiaceae, Boraginaceae, Verbenaceae, Labiatae, Selaginaceae, Globulariaceae,* and *Stilbaceae,* and after the discussion of *Verbenaceae* it is stated "*Avicennia* is allied to this order." In 1912 Warming proposed [49] the order *Verbenales* for the *Labiatae* and *Verbenaceae* and in a note says that *Avicennia* "is related" to this order. Meissner, Schauer, and Bentham maintained the species of *Avicennia* as constituting a separate and final tribe of the *Verbenaceae,* while Briquet made of them a subfamily.

Finally, Van Tieghem, in 1898, after a detailed discussion [50], proposed the segregation of the family "les Symphoremacées." This has recently been formally published as the *Symphoremaceae* [51] and contains the genera *Congea, Sphenodesme,* and *Symphorema.*

In addition to these 21 genera which have been made into separate families, it is interesting to review the 53 other genera which have from time to time been placed in the *Verbenaceae,* but actually are now regarded as belonging to entirely different families, although they do not happen to be the type genera of any of these families. Among these are *Aeolanthus* Mart. *(Lamiaceae), Alguelagen* Feuill. *(Lamiaceae), Amethystea* L. *(Lamiaceae), Asaphes* Spreng. *(Dipsacaceae), Basistemon* Turcz. *(Scrophulariaceae), Bravaisia* P. DC. *(Acanthaceae), Bruschia* Bertol. *(Oleaceae), Buchia* H. B. K. *(Rubiaceae), Buddleja* Houst. *(Loganiaceae), Chilianthus* Burch. *(Loganiaceae), Clerodendranthus* Kudo *(Lamiaceae), Cobamba* Blanco *(Gentianaceae), Coch-*

ranea Miers *(Heliotropiaceae)*, *Colebrookea* J. Sm. *(Lamiaceae)*, *Conocarpus* L. *(Combretaceae)*, *Contarenia* Vand. *(Scrophulariaceae)*, *Cumbulu* Rheede *(Bignoniaceae)*, *Dissolaena* Lour. *(Apocynaceae)*, *Eranthemum* L. *(Acanthaceae)*, *Erythrostaphyle* Hance *(Olacaceae)*, *Espadaea* A. Rich. *(Goetziaceae)*, *Gonzalea* Pers. *(Rubiaceae)*, *Guapira* Aubl. *(Pisoniaceae)*, *Gynastrum* Neck. *(Pisoniaceae)*, *Hilsenbergia* Tausch *(Solanaceae)*, *Lycopus* Tourn. *(Lamiaceae)*, *Mattuschkia* Schreb. *(Rubiaceae)*, *Melananthus* Walp. *(Solanaceae)*, *Mendoncia* Vell. *(Acanthaceae)*, *Mendozia* Ruíz & Pav. *(Acanthaceae)*, *Michelia* Houst. *(Pontederiaceae)*, *Morina* Don *(Dipsacaceae)*, *Nuxia* Lam. *(Scrophulariaceae)*, *Pentaptelion* Turcz. *(Epacridaceae)*, *Perama* Aubl. *(Rubiaceae)*, *Phlyarodoxa* S. L. Moore *(Oleaceae)*, Plotia Neck. *(Myrsinaceae)*, *Premnophyllum* Velenovský *(Vitaceae)*, *Rapunea* Aubl. *(Myrsinaceae)*, *Raputia* Aubl. *(Rutaceae)*, *Rosenbeckia* Reg. *(Lamiaceae)*, *Saccanthus* Herzog *(Scrophulariaceae)*, *Schnabelia* Hand.-Mazz. *(Lamiaceae)*, *Schwalbea* Gron. *(Scrophulariaceae)*, *Sciuris* Schreb. *(Rutaceae)*, *Tetreilema* Turcz. *(Frankeniaceae)*, *Tozzia* Mich. *(Scrophulariaceae)*, *Vadakodi* Rheede *(Acanthaceae)*, *Wallenia* Sw. *(Myrsinaceae)*, and four genera whose family position has not yet been definitely determined—*Aganon* Raf., *Camax* Schreb., *Idesia* Scop., and *Ropourea* Aubl.

On the other hand, some genera now considered to be verbenaceous have been placed in other families by various authors. A. de Candolle in 1847 placed[52] *Nesogenes* A. DC., *Dasymalla* Endl. [=*Pityrodia*], and *Spartothamnus* A. Cunn. [=*Spartothamnella*] in the *Myoporaceae*. Bentham[29] and Briquet[30] placed *Tetraclea* A. Gray in the *Lamiaceae*. Agardh in 1858 proposed the segregation[53] of two additional families, the *Petreaceae* for the genus *Petrea* and the *Durantaceae* for the genus *Duranta*. Wittstein[54] classified *Agricolaea* Schrank [=*Clerodendrum*], *Denisaea* Neck. [=*Bouchea*], and *Hastingsia* Sm. [=*Holmskioldia*] in the *Lamiaceae*, *Eurylobium* Hochst. in the *Plumbaginaceae*, *Racka* Bruce [=*Avicennia*] in the *Myoporaceae*, and *Quoya* Gaudich. [=*Pityrodia*] in the *Bignoniaceae*. Muller[55] and Jackson[56] considered *Depremesnilia* F. Muell. [=*Pityrodia*] to belong in the *Lamiaceae*. *Tatea* F. Muell. [=*Pygmaeopremna*] was reduced to synonymy under *Avicennia* by Ewart & Davies according to Green[57], but not in the reference which she cites! Such a reduction is ridiculous! *Aegiphila* and *Callicarpa* were placed in the *Lamiaceae* by Reichenbach, and the former also in that family by Steudel[168]. "The entire *Verbenaceae*, in its broadest sense, was included in the *Lamiaceae* by H. G. L. Reichenbach in Mössler, Handb. Gewachsk., ed. 1, 1: xxvi (1827) and ed. 3, 1: lxxv (1833) and his own Conspect. Reg. Veg. 1: 117 (1828),[169] as tribe "*Verbeneae*" coordinate with tribes "*Salvieae*" and "*Nepeteae.*" Beetle, apparently unintentionally, places *Verbena* in the "*Cruciferae*" [=*Brassicaceae*] in Bot. Review 9: 674 (1943).

The following is a schematic classification of the *Lamiales* as this order is regarded by us at the present time. Much work still remains to be done, and it is to be plainly understood that this outline is still

very tentative. In the following table all the genera as accepted by us are listed, but only 190 of the most important generic synonyms are given; 152 additional generic synonyms, mostly variations in spelling or accredition, will be found recorded in a previous publication [58].

Family 1. *Globulariaceae* Dumort.
- Genus 1. *Lytanthus* Wettst.—2 species.
- Genus 2. *Globularia* L. (*Abolaria* Neck., *Alypum* Fisch.)—26 species.
- Genus 3. *Cockburnia* I. B. Balf.—2 species.

Family 2. *Myoporaceae* Lindl.
- Genus 1. *Myoporum* Banks & Soland. (*Polycoelium* A. DC.)—45 species.
- Genus 2. *Pholidia* R. Br.—39 species.
- Genus 3. *Eremophila* R. Br. (*Eremodendron* A. DC., *Stenochilus* R. Br.)—101 species.
- Genus 4. *Oftia* Adans. (*Spielmania* Dumort., *Spielmannia* Medic.) —3 species and varieties.
- Genus 5. *Bontia* L.—1 species.
- Genus 6. *Zombiana* Baill.—1 species.

Family 3. *Selaginaceae* Lindl.
- Genus 1. *Hebenstretia* L. (*Hebenstreitia* L.)—42 species.
- Genus 2. *Dischisma* Choisy—13 species.
- Genus 3. *Walafrida* E. Mey.—31 species.
- Genus 4. *Selago* L.—146 species.
- Genus 5. *Microdon* Choisy—7 species.
- Genus 6. *Gosela* Choisy—1 species.
- Genus 7. *Agathelpis* Choisy—6 species.

Family 4. *Stilbaceae* Lindl. (*Stilbinaceae* Möbius).
- Genus 1. *Campylostachys* Kunth—1 species.
- Genus 2. *Stilbe* Berg.—6 species.
- Genus 3. *Euthystachys* A. DC.—1 species.
- Genus 4. *Xeroplana* Briq.—1 species.
- Genus 5. *Eurylobium* Hochst.—1 species.

Family 5. *Symphoremaceae* Moldenke.
- Genus 1. *Symphorema* Roxb. (*Analectis* Juss.)—4 species.
- Genus 2. *Sphenodesme* Jack (*Sphaenodesma* Jack, *Viticastrum* Presl)—21 species and varieties.
- Genus 3. *Congea* Roxb. (*Calochlamys* Presl, *Roscoea* Roxb.)—10 species and varieties.

Family 6. *Avicenniaceae* Endl.
- Genus 1. *Avicennia* L. (*Anacardium* Bauhin, *Auicennia* Sessé & Moc., *Bontia* L.[59], *Donatia* Loefl., *Halodendron* Roem. & Schult., *Halodendrum* Thou., *Hilairanthus* Van Tiegh., *Oepata* Rheede, *Racka* Bruce, *Racka* J. F. Gmel., *Sceura* Forsk., *Upata* Adans.)—19 species and varieties.

Family 7. *Verbenaceae* J. St.-Hil. (*Durantaceae* Agardh, *Petreaceae* Agardh, *Pyrenaceae* Vent., *Verbaceae* Link, *Verbenae* Adans., *Vervenaceae* De Wild., *Vitices* A. L. Juss.)

Subfamily 1. *Verbenoideae* Briq.

Tribe 1. *Euverbeneae* Briq.

Genus 1. *Verbena* L. (*Aubletia* Jacq., *Billardiera* Moench, *Glandularia* J. F. Gmel., *Helleranthus* Small, *Obletia* Rozier, *Patya* Neck., *Shuttleworthia* Meissn., *Uerbena* Sessé & Moc., *Uwarowia* Bunge)—287 species and varieties.

Genus 2. *Stylodon* Raf. (*Styleurodon* Raf.)—1 species.

Genus 3. *Verbenophyllum* Ettingsh.—1 species.

Genus 4. *Urbania* R. A. Phil.—2 species.

Genus 5. *Junellia* Moldenke (*Monopyrena* Speg.?)—60 species and varieties.

Genus 6. *Hierobotana* Briq.—1 species.

Genus 7. *Ghinia* Schreb. (*Ischina* Walp., *Ischnia* P. DC., *Kaempfera* Houst., *Kempfera* Houst., *Leptocarpus* Willd., *Maceria* P. DC., *Tamonea* Aubl.)—8 species and varieties.

Tribe 2. *Lantaneae* Endl.

Genus 8. *Burroughsia* Moldenke—2 species.

Genus 9. *Nashia* Millsp.—7 species.

Genus 10. *Lantana* L. (*Camara* Plum., *Charachera* Forsk., *Myrobatindum* Vaill., *Riedelia* Cham., *Tamonopsis* Griseb.)—177 species and varieties.

Genus 11. *Acantholippia* Griseb.—4 species.

Genus 12. *Aloysia* Ortega (*Aloisia* Cárdenas, *Aloysium* Correa)—42 species and varieties.

Genus 13. *Phyla* Lour. (*Bertolonia* Raf., *Blairia* Gaertn., *Cryptocalyx* Benth., *Libbia* Creek, *Lipia* Sessé & Moc., *Panope* Raf., *Piarimula* Raf., *Platonia* Raf., *Zampania* Bedevian, *Zapama* Scop.)—16 species and varieties.

Genus 14. *Lippa* Houst. (*Dipterocalyx* Cham., *Goniostachyum* (Schau.) Small, *Zappania* Scop.)—230 species and varieties.

Genus 15. *Thryothamus* R. A. Phil. (*Tryothamnus* Phil.)—1 species.

Genus 16. *Neosparton* Griseb.—3 species.

Genus 17. *Ubochea* Baill.—1 species.

Genus 18. *Bouchea* Cham. (*Bruechea* Shafer, *Denisaea* Neck., *Lomake* Raf.)—18 species and varieties.

Genus 19. *Chascanum* E. Mey. (*Deniseia* Neck., *Denisia* Post & Kuntze, *Gisania* Ehrenb., *Pleurostigma* Hochst., *Plexipus* Raf., *Ragasia* Schrad.)—30 species and varieties.

Genus 20. *Svensonia* Moldenke—2 species.

Genus 21. *Diostea* Miers—3 species.
Genus 22. *Stachytarpheta* Vahl (*Abena* Neck., *Cymburus* Salisb., *Melasanthus* Pohl, *Sherardia* Adans., *Stachytarpha* Link, *Stachytapenta* Parham, *Tarpheta* Raf., *Valerianodes* Medic., *Valerianoides* Boerh.)—124 species and varieties.
Tribe 3. *Priveae* Briq.
Genus 23. *Dipyrena* Hook. (*Wilsonia* Gill. & Hook.)—1 species.
Genus 24. *Castelia* Cav. (*Phelloderma* Miers, *Pitraea* Turcz.)—1 species.
Genus 25. *Priva* Adans. (*Blairia* Houst., *Burseria* Loefl., *Phryma* Forsk., *Streptium* Roxb., *Tortula* Roxb., *Zapania* Lam., *Zappania* Zuccagni)—20 species and varieties.
Tribe 4. *Monochileae* (Schau.) Briq.
Genus 26. *Monochilus* Fisch. & Mey.—1 species.
Genus 27. *Amasonia* L. f. (*Diphystema* Neck., *Diplostemma* Neck., *Hassleria* Briq., *Taligalea* Aubl.)—9 species and varieties.
Tribe 5. *Petraeeae* Briq.
Genus 28. *Petrea* Houst. (*Pehoia* L., *Petraea* Jacq.)—37 species and varieties.
Genus 29. *Lampaya* R. A. Phil.—3 species.
Genus 30. *Timotocia* Moldenke (*Casselia* Nees & Mart.)—13 species and varieties.
Genus 31. *Recordia* Moldenke—1 species.
Tribe 6. *Citharexyleae* Briq.
Genus 32. *Coelocarpum* Balf. f.—2 species.
Genus 33. *Duranta* L. (*Castorea* Plum., *Ellisia* P. Br.. *Hoffmannia* Loefl.)—43 species and varieties.
Genus 34. *Baillonia* Bocq.—2 species and varieties.
Genus 35. *Parodianthus* Troncoso—1 species.
Genus 36. *Rehdera* Moldenke—3 species.
Genus 37. *Citharexylum* B. Juss. (*Atharexylum* Mill., *Cacocalyx* S. Wats., *Citharexylon* L., *Cutarexylon* Sessé & Moc., *Maroxylon* Zucc., *Rauwolfia* Ruíz & Pav., *Scleroon* Benth.)—127 species and varieties.
Genus 38. *Rhaphithamnus* Miers (*Guayunia* C. Gay, *Poeppigia* Bert.)—2 species.
Subfamily 2. *Chloranthoideae* Briq.
Tribe 7. *Achariteae* Briq.
Genus 39. *Acharitea* Benth.—1 species.
Genus 40. *Nesogenes* A. DC.—6 species.
Genus 41. *Cyclocheilon* Oliv.—3 species and varieties.
Genus 42. *Pityrodia* R. Br. (*Dasymalla* Endl., *Depremesnilia* F. Muell., *Quoya* Gaudich.)—26 species and varieties.

Tribe 8. *Chloantheae* Benth.
Genus 43. *Denisonia* F. Muell.—1 species.
Genus 44. *Chloanthes* R. Br.—11 species and varieties.
Genus 45. *Hemiphora* F. Muell.—1 species.
Genus 46. *Cyanostegia* Turcz. (*Bunnya* F. Muell.)—4 species.
Tribe 9. *Physopsideae* Briq.
Genus 47. *Mallophora* Endl. (*Lachnocephalus* Turcz.)—2 species.
Genus 48. *Physopsis* Turcz.—2 species.
Genus 49. *Dicrastylis* J. Drummond (*Dicrostyles* J. Drummond)—15 species.
Genus 50. *Newcastlia* F. Muell.—10 species and varieties.
Genus 51. *Lachnostachys* Hook. (*Pycnolachne* Turcz., *Walcottia* F. Muell.)—10 species.
Subfamily 3. *Viticoideae* Briq.
Tribe 10. *Callicarpeae* Briq.
Genus 52. *Aegiphila* Jacq. (*Amerina* P. DC., *Brückea* Klotzsch & Karst., *Manabea* Aubl., *Omphalococca* Willd., *Pseudaegiphila* Rusby, *Stigmatococca* Mart.) —163 species and varieties.
Genus 53. *Callicarpa* L. (*Amictonis* Raf., *Burcardia* Mill., *Burchardia* Heist., *Illa* Adans., *Johnsonia* Catesb., *Porphyra* Lour., *Spondylococca* L., *Spondylococcus* Mitch., *Tomex* L.)—165 species and varieties.
Genus 54. *Geunsia* Blume—14 species.
Genus 55. *Schizopremna* Baill.—1 species.
Tribe 11. *Tectoneae* Briq.
Genus 56. *Petitia* Jacq.—4 species and varieties.
Genus 57. *Tectona* L. f. (*Cajatana* Thunb., *Nautea* Noronha, *Tectonia* Spreng., *Theka* Rheede)—4 species.
Tribe 12. *Viticeae* (Bartl.) Benth.
Genus 58. *Pygmaeopremna* Merr. (*Tatea* F. Muell.)—5 species.
Genus 59. *Rapinia* Montr.—1 species.
Genus 60. *Cornutia* Plum. (*Agnanthus* Vaill., *Cornuta* L., *Hosta* Jacq., *Hostana* Pers.)—25 species and varieties.
Genus 61. *Adelosa* Blume—1 species.
Genus 62. *Tsoongia* Merr.—1 species.
Genus 63. *Premna* L. (*Baldingera* Dennst., *Cornutia* Burm., *Gumira* Rumph., *Holochiloma* Hochst., *Permna* Dumort., *Phoenicanthus* Thwaites, *Scrophularioides* Forst.)—205 species and varieties.
Genus 64. *Viticipremna* H. J. Lam—2 species.
Genus 65. *Vitex* Tourn. (*Agnus castus* Blackw., *Agnus-castus* Tourn., *Calymega* Poit., *Casarettoa* Walp.,

Verbena foliis ovatis acuminatis, ſpica folioſa. *Hort. cliff.* 10. *

Verbena orubica, teucrii folio, primulæ veris flore, ſiliquis & ſeminibus longiſſimis. *Pluk. alm.* 383. *t.* 228. *f.* 4. & *t.* 327. *f.* 7.

Sherardia urticæ folio ſubtus incano, floribus violaceis. *Ehret. pict. t.* 5. *f.* 1.

Habitat in Oruba *inſula americes ſeptentrionalis.*

2. VERBENA diandra, ſpicis longiſſimis carnoſis ſubnudis. *jamaicenſis.*

Verbena foliis obtuſe ovalibus, ſpica carnoſa nuda. *Hort. cliff.* 10. *Roy. lugdb.* 327.

Verbena folio ſubrotundo ſerrato, flore cæruleo. *Sloan. hiſt.* 171. *t.* 107. *f.* 1.

Habitat in Jamaica & Caribæis. ♃ ☉

3. VERBENA diandra, ſpicis ovatis, foliis lanceolatis ſerrato-plicatis, caule fruticoſo. *Roy. lugdb.* 327. *ſtœchadifol.*

Sherardia nodiflora, ſtœchadis ſerratifolii folio. *Vaill. ſex.* 49.

Lavandula, foliis crenatis latioribus, americana frutescens. *Plum. ſpec.* 6.

Habitat in America *Galliæ æquinoctialis.*

4. VERBENA diandra, ſpicis laxis, calycibus alternis priſmatic's truncatis ariſtatis, foliis ovatis obtuſis. *priſmatica.*

Verbena minima, chamædryos folio, *Sloan. jam.* 64.

Habitat in Jamaica.

5. Verbena diandra, ſpicis laxis, calycibus fructus reflexo-pendulis ſubglobo ſis hiſpidis. *mexicana.*

Verbena mexicana, trachelii folio, fructu aparines: *Dill. elth.* 407. *t.* 302. *f.* 389.

Habitat in Mexico.

6. VERBENA diandra, calycibus ſubrotundis erectiuſculis, ſeminibus echinatis. *lappulacea.*

Scorodinia floribus ſpicatis purpuraſcentibus pentapetaloidibus. *Sloan. jam.* 66.

Blairia *Houſt. Amn. herb.* 277.

Habitat in Jamaica.

7. VERBENA diandra, ſpicis longis, calycibus ariſtatis, foliis ovatis argute ſerratis *curaſſavica.*

Veronicæ ſimilis fruticoſa curaſſavica. *Herm. parad.* 240.

Kempfera. *Houſt. m. ſſ.*

Habitat in Curaſſao *Americes.*

Page from the first edition of "Species Plantarum" by Carl von Linné, 1753, on which appear his descriptions of what are now called **Stachytarpheta orubica** (L.) Vahl, **S. jamaicensis** (L.) Vahl, **Phyla stoechadifolia** (L.) Small, **Bouchea prismatica** (L.) Kuntze, **Priva mexicana** (L.) Pers., **P. lappulacea** (L.) Pers., and **Ghinia curassavica** (L.) Millsp., all placed in the genus **Verbena** by Linné.
Plate 6

Chrysomallum Thou., *Ephialis* Banks & Soland., *Limia* Vand., *Macrostegia* Nees, *Nephrandra* Willd., *Psilogyne* A. DC., *Pyrostoma* G. F. W. Mey., *Wallrothia* Roth)—346 species and varieties.

Genus 66. *Paravitex* Fletcher—1 species.

Genus 67. *Pseudocarpidium* Millsp.—8 species.

Genus 68. *Kalaharia* Baill.—1 species.

Genus 69. *Gmelina* L. (*Michelia* Amman)—37 species and varieties.

Tribe 13. *Clerodendreae* Briq.

Genus 70. *Faradaya* F. Muell. (*Tetrathyranthus* A. Gray)—18 species and varieties.

Genus 71. *Huxleya* Ewart—1 species.

Genus 72. *Archboldia* Beer & Lam—1 species.

Genus 73. *Oxera* Labill.—31 species and varieties.

Genus 74. *Hosea* Ridl. (*Hoseanthus* Merr.)—1 species.

Genus 75. *Clerodendrum* Burm. (*Agricolaea* Schrank, *Clerodendron* R. Br., *Cornacchinia* Savi, *Cyclonema* Hochst., *Cyrtostemma* Kunze, *Douglassia* Houst., *Egena* Raf., *Megalosiphon* Ekman, *Montalbania* Neck., *Ovieda* L., *Rotheca* Raf., *Siphonanthemum* Amm., *Siphonanthus* L., *Spironema* Hochst., *Torreya* Spreng., *Valdia* Plumb.)—454 species and varieties.

Genus 76. *Holmskioldia* Retz. (*Hastingsia* Sm., *Holmskidia* Dumort., *Platumium* Juss.)—5 species.

Genus 77. *Karomia* Dop—1 species.

Genus 78. *Teucridium* Hook. f.—1 species.

Genus 79. *Oncinocalyx* F. Muell.—1 species.

Genus 80. *Spartothamnella* Briq. (*Spartothamnus* A. Cunn.)—3 species.

Genus 81. *Tetraclea* A. Gray—3 species and varieties.

Subfamily 4. *Caryopteridoideae* Briq.

Tribe 14. *Teijsmanniodendreae* Koord.

Genus 82. *Teijsmanniodendron* Koord. (*Teysmannioden-dron* Koord.)—6 species.

Genus 83. *Xerocarpa* H. J. Lam—1 species.

Tribe 15. *Caryopterideae* Moldenke.

Genus 84. *Caryopteris* Bunge (*Barbula* Lour., *Callipeltis* Bunge, *Mastacanthus* Endl.)—16 species and varieties.

Genus 85. *Garrettia* Fletcher—2 species.

Genus 86. *Glossocarya* Wall.—8 species.

Genus 87. *Varengevillea* Baill.—1 species.

Genus 88. *Peronema* Jack—1 species.

Genus 89. *Petraeovitex* Oliv.—11 species and varieties.

Genus 90. *Hymenopyramis* Wall.—5 species.

Family 8. *Lamiaceae* Lindl. (*Labiaceae* Neck., *Labiataceae* De Wild., *Labiatae* B. Juss., *Menthaceae* Clements, *Nepetaceae*

Horan., *Salviaceae* Drude, *Verticillatae* L.)—about 160 genera and 3200 species.

It is thus quite evident that in spite of the several family segregations which it has suffered and the many genera and species which have been excluded, the *Verbenaceae* has been steadily increasing in size from the time of Linné, who recognized 16 genera and 50 species, to the present day when we accept 90 genera and 3036 specific and subspecific entities, with over 6100 names reduced to synonymy [58]. In order for our knowledge of the group to have been built up to this extent the labor of at least 7000 men and women has been required in publication, critical study of preserved material, collection of specimens, and other contributions. An alphabetic list of these contributors is now in preparation. It would be difficult to select from this large list a group which might be described as having contributed the most essential information, for that of necessity disparages the contributions of the others. Actually, the value of the contribution made by even the most casual amateur collector who collects only a single specimen may be as great as that of an author who has published 100 pages on the group. It is through the steady accretion of little bits of information, from hundreds of men and women in every part of the globe, of all races and creeds and colors and ages and nationalities, that we have derived our present scientific edifice. However, it might prove of interest and value to mention very briefly the work of just a few who seem to have made among the most outstanding contributions, remembering that "Back of every accomplishment there is a human being. The mere narration of results achieved makes history, but the most interesting phase of history is that which has to do with the men who have accomplished that which makes history." [60] The same thought has been expressed equally well in another tongue: "Das Leben und Wirken eines Tuchtigen Menschen bleibt für alle Ewigkeit ein Schrift auf dem Wege des Bildungsganges der Menschheit." [61]

In the broad field of systematics the authors mentioned so far—the Frenchmen, Adanson, Necker, Jussieu, Ventenat, Jaume Saint-Hilaire, and Dumortier; the Swedes, Linné and Junell; the Germans, Bartling, Endlicher, Walpers, and Schauer; the Englishmen, Lindley, Sweet, and Bentham; and the Swiss, Meissner and Briquet [62]—have, of course, made the most outstanding contributions, but others of considerable importance were the Frenchman, Bocquillon [63]; the Russian, Turczaninow [64]; the Englishmen, Miers [65] and Hemsley [66]; the Belgian, De Wildeman [67]; the Argentinian, Troncoso [68]; the Austrians, Fenzl [69] and Hayek [70]; the Chilean, Sanzin [71]; the Hollander, Meeuse [72]; the Indian, Biswas [73]; and the Americans, Greenman [74], Grenzebach [75], and Kobuski [76].

In the field of floristics one cannot forget the tremendous contributions made by Robert Brown and Friedrich von Mueller in their work on the Australian members of the group; of E. Meyer, Thunberg, Bolus, and H. H. W. Pearson [77] in South Africa; of J. G. Baker and O. Stapf [78], Gürke, Oliver, Mildbraed, Hutchinson, Schinz, and Berthold Thomas [79]

in tropical Africa; of Hochstetter, Chiovenda, and Schweinfurth in northern Africa; of C. B. Clarke [80], Wallich, Roxburgh, and Craib in India, Ceylon, and Burma; of Fletcher [81], Dop [82], Ridley, H. J. Lam [83], King, and Gamble in Siam, Indo-china, and the Malayan Archipelago; of Blume, Hallier [84], Bakhuizen van den Brink [85], Koorders and Valeton, Beccari, Teijsmann and Binnet, and Miquel in the Dutch East Indies; of Merrill, Quisumbing, Elmer, and Blanco in the Philippines; of Handel-Mazzetti, Rehder [86], Léveillé, and P'ei [87] in China; of Koidzuma, Hayata, Matsuda, Nakai, Makino, and Siebold and Zuccarini in Japan; of Asa Gray, Greene, Perry [88], Small, Rydberg, Torrey, and Michaux in the United States; of Britton, Percy Wilson, Urban, A. Richard, Millspaugh, Grisebach, Swartz, and Jacquin in the West Indies; of P. C. Standley in Central America and Mexico; of Pittier, Karsten, and Humboldt and Bonpland in Venezuela; of Ruíz and Pavon in Peru; of Sandwith in the Guianas; of Velloso, Huber [89], Ducke, Chamisso, and Schauer in Brazil; of Chodat in Paraguay; of Rusby in Bolivia; of Spegazzini, Philippi, Gillies, and Hooker in Chile and Argentina. A bibliography of Argentine *Verbenaceae* is given by Castellanos and Perez-Moreau in Lilloa *7:* 273—278 (1941).

In the realm of morphology the outstanding contributors have been Wydler [90], Payer [91], Lang [92], Bocquillon [63], Chatin [93], Rosanoff [94], Eichler [95], K. Schumann [96], Briquet [30], Junell [31], and Erdtman [46]. In anatomy one cannot overlook the contributions of Möller [97], Solereder [98], Born [99], Vesque [100], Schenck [101], Briquet [30], and Record [45]. In recent years there has been considerable activity among workers on the genetics of the group. Notable in this field have been Schaffner [102], Beale [103], Schnack and Covas [104], Kanda [105], Lecocq [106], Noack [107], Dermen [108], and Winge [109]. Chromosome numbers have been determined for 38 species and varieties of *Verbena.* Thirty different interspecific hybrids have been described in the same genus and several in *Vitex* and *Callicarpa.*

Considerable has been published on the cytology and embryology of the *Verbenaceae* and *Avicenniaceae,* notably by Treub [110], Hofmeister [111], Dahlgren [112], Schnarf [113], Schwencke [114], Patermann [115], Misra [116], Karsten [117], Maheshwari [118], Pammel and King [119], Heit [120], Tatachar [121], Blanford [122], Denoga [123], Eidmann [124], Hill [125], Japing [126], and Laurie [127]. Work has recently been done on the viability of seeds of *Verbena* by Crocker [128], Goss [129], Barton [130], and Shull [131]. Seeds of *Verbena urticifolia* showed 90 percent germination after burial for 20 years for a depth of 22 inches and 78 percent germination when buried 42 inches!

Since the *Verbenaceae* and its related families comprise groups of plants that are practically world-wide in distribution, it follows that there is almost no botanical collector of any significance who has not collected material of these families. There is hardly a single region on the face of the earth with the exception of the far north, Antarctica, and the driest parts of the larger deserts, where one cannot expect to find at least some of the 3565 species and varieties of *Verbenaceae,*

Avicenniaceae, Stilbaceae, Symphoremaceae, Selaginaceae, Myoporaceae, or *Globulariaceae.* In Europe and the eastern Atlantic islands there are 8 native or naturalized genera and 43 species and varieties; in Asia Minor, 13 genera and 28 species; in continental Asia and the islands of the Indian Ocean, 37 genera and 456 species and varieties; in the Asiatic and Pacific islands, including Japan, the Philippines, Dutch East Indies, and Hawaii, 36 genera and 535 species and varieties; in Australia, New Zealand, and Tasmania, 29 genera and 302 species and varieties; in Africa, Madagascar and the coastal islands, 39 genera and 809 species and varieties; in North America, 18 genera and 149 species and varieties; in Mexico and Central America, 22 genera and 335 species and varieties; in the West Indies and the islands of the western Atlantic and of the Caribbean Sea, 26 genera and 237 species and varieties; and in South America, 36 genera and 976 species and varieties. We see, thus, that the groups reach their greatest development in the tropical and subtropical regions of the world —South America, Africa, the Asiatic and Pacific islands, and continental Asia ranking highest in number of species. However, the group is also highly developed in temperate regions, with the exception of Europe. The following table indicates the abundance of the groups in the largest countries on the various continents and on the largest islands according to our present knowledge:[132]

	species & varieties		species & varieties
Brazil	436	Costa Rica	67
Union of South Africa	337	Jamaica	67
Australia	297	Straits Settlements	66
Mexico	256	Panama	62
Argentina	200	Celebes	59
Peru	158	Uruguay	57
China	155	Lesser Sunda Islands	57
U. S. A.	148	Madagascar	56
India	147	Puerto Rico	53
Colombia	141	Molucca Islands	50
Philippine Islands	140	Portuguese East Africa	50
French Indo-China	135	New Caledonia	49
Paraguay	130	Hainan Island	48
Tanganyika Territory	125	Kenya	46
Cuba	123	Trinidad	42
Thailand	115	Formosa	37
Bolivia	112	Ceylon	32
Borneo (island)	111	Abyssinia	32
Venezuela	106	Japan	31
Java	102	Anglo-Egyptian Sudan	26
Belgian Congo	93	Hawaiian Islands	20
Sumatra	89	Spain	18
New Guinea	89	Egypt	12
Guatemala	85	Italy	12
Chile	84	Greece	10

	species & varieties		species & varieties
Burma	84	France	9
Cameroons	83	Switzerland	7
Federated Malay States	81	Canada	7
Angola	80	Germany	5
Ecuador	77	U. S. S. R.	4
Hispaniola	76	Manchukuo	2

Of course, it must be borne in mind that not all parts of the earth have yet been botanized with equal intensity. Some countries and islands have been worked over by botanical collectors with great thoroughness and probably few, if any, new species or varieties remain to be discovered there. Other countries and islands, some of considerable extent, have been barely touched botanically. Also, it must be borne in mind that while the authors of this paper have examined over 102,000 herbarium specimens from 186 of the world's leading institutional and private herbaria, they have as yet not covered nearly all of the herbarium material that is available, and the above statistics are based almost entirely on only the material they have thus far actually examined and verified. It is, for example, very certain that the figures for Burma and the Belgian Congo will be very much larger when more exploration and botanizing are done there and when more material has been examined by us. On the other hand, the census for Canada, the U. S. S. R., Egypt, and Europe will probably not change much, except as exotic material becomes naturalized in those areas.

Not only are members of these groups found in the larger and better known countries and islands listed above, but they have been found on such out-of-the-way islands, for instance, as Cozumel, Cedros, and Socorro islands off the coasts of Mexico; the Swan islands off the coast of Central America; Crab Island, Culebra, Water Island, Virgin Gorda, St. John, Tortola, Anegada, Anguilla, Saba, St. Eustache, St. Kitts, Nevis, Barbuda, Desirade, Marie Galante, Los Saintes, Bequia, Mustigue, Union, and Grenada in the West Indies; Cedros, Monos, Gasparee, Patos, Aruba, Bonaire, Margarita, San Andres, and Cocos islands off the northern coasts of South America; the lonely Galapagos and Juan Fernandez islands off the western coast of South America; Bermuda, Fernando Noronha, Tristan da Cunha, Madeira, the Azores, and the Canary islands in the Atlantic; Schech Said, Adjuna, Saad-ed-din, Cape Verde, Turtle, Fernando Po, St. Thomas, Principe, and Annobon islands off the north and west African coasts; Zanzibar, Lamu, Salisbury, Europa, Comoro, Seychelles, and Mascarene islands off the east African coasts; Genobi, Socotra, and Réunion islands south of Arabia; Aru, White Dog, Lantau, and Lappa islands off the Chinese coasts; the Liukiu, Bonin, Marianna, Caroline, Madura, Bawean, Karimun Djawa, Mantawi, Kambangan, Banguey, Sangir, Talaut, Kaloe, Kaloekoeang, Kabaena, Tukang-besi, Adi, Mansinama, Midway, Radack, Admiralty, Hermit, Solomon, Loyalty, Tonga, Fiji, Samoan, Bismark, and Niue islands in the far reaches of the Pacific; Norfolk, Thursday, Houtman

Rocks, Prince of Wales, Northumberland, Bribie, and Lord Howe islands off the Australian coasts; and even those tiny specks in the South Pacific ocean, the Society, Cook, Austral, Marquesa, Tuamoto, Pitcairn, and Easter islands. *Premna cyclophylla* grows on the precipitous slopes of Krakatoa, and *Verbena officinalis* has been collected on the island of Tristan da Cunha at the northern limit of Antarctic icebergs.

No discussion of the *Verbenaceae* and related groups would be complete without some acknowledgment, at least, of the wonderful work done by botanical collectors all over the world, often under the most trying and hazardous conditions of terrain, climate, and hostile natives. Some of these collectors have endured the most unspeakable privations and hardships in the course of their work—several suffered shipwreck; several caught in the midst of wars, had all their collections confiscated and destroyed by hostile armies or navies; at least one was held captive in a foreign land for many years; some were caught in revolutions and mutinies; one was cast adrift in a small boat in the South Pacific. Many have exposed themselves to and contracted all manner of diseases which have wracked their bodies with pain. One, known to the authors of this paper, went on a collecting trip a healthy vigorous young man and returned in 2 years shattered in body and spirit; another, accidentally caught in no-man's-land in an unexpected Chinese border incident, was fired upon by 3 armies while collecting; another was lost for days without food in a bamboo jungle and later was captured by head-hunters; another, in a fever delirium, was placed in an open grave in the Bolivian jungle by his guides who sat about waiting for him to die so that they could fill in the grave and return to their respective homes. Several, at least, have given their lives. One was captured and eaten by a crocodile while crossing the White Nile; several were murdered by natives; some just set out into the jungles and never returned. And all of these sacrifices were made by men who were collecting plants for the advancement of scientific knowledge and for the benefit of those of us who stay at home in our comfortable offices and study herbarium specimens from distant lands that we have never seen.

Never can we forget the collections of A. D. E. Elmer in British North Borneo and the Philippines, as well as on the western coasts of North America, or those of Kotschy in Nubia and Bequaert in the Congo, or those of Faurie in Korea and of Tanaka and Shimada in Formosa. Never to be forgotten are the collections of Glaziou, Hoehne, Ule, Gardner, Clausen, Warming, Blanchet, Martius, Ducke, Dusén, and Sellow in Brazil, the collections of Krukoff in Bolivia, Brazil, and Sumatra, or those of that intrepid lady, Ynes Mexia, in Brazil, Ecuador, and Mexico. Of inestimable value have been the thousands of specimens painstakingly gathered and brought back by Rusby, Bang, Steinbach, and Mandon from Bolivia, and by Killip and Smith from Colombia and Peru. How little we would know of the flora of Paraguay had it not been for the labors of Balansa, Hassler, Morong, and Jorgensen, or of Uruguay had it not been for Arechavaleta, Herter, Rosengurtt,

and Sellow. Indissolubly connected with the flora of Venezuela are the names of Moritz, Funck, Schlim, and Pittier, of New Britain and New Guinea is that of Herre, of the Cameroons is that of Zenker, of Colombia Linden, Mutis, Lehmann, Pennell, and Cuatrecasas, of the Galapagos Darwin, Skottsberg, Snodgrass, and Heller, of Hawaii Degener and St. John. No one but the systematists who pore for days and weeks and years over the often pathetically inadequate material available in herbaria and try to arrive at basic concepts of taxonomy therefrom, can realize the importance of the work of Smith and Gillespie in the Fiji Islands, of Yuncker on Niue, of Pritzel, White, and Robert Brown in Australia, of Lundell, Barkley, Clover, Runyon, Warnock, Lindheimer, and Tharp in Texas, of Deam in Indiana, of Gates and Hitchcock in Kansas, of Brenes, Oersted, and Pittier in Costa Rica, of Calderón in El Salvador, of Türckheim and Steyermark in Guatemala, of Ekman, Fuertes, and the Leonards in Hispaniola, of Shafer, León, Ekman, Clément, Wright, Acuña, Roig, and Carabia in Cuba, of William Harris, Alexander Prior, and Purdie in Jamaica, of Williams, Mathews, and Klug in Peru, of T. Meyer, Descole, Bruch, Cabrera, Castellanos, Job, Venturi, Scala, Vignati, Rodrigo, Boffa, Chicchi, Rodriguez, Maldonado, Carette, A. G. Schulz, Alboff, Schreiter, Lorentz, Dawson, Roth, Hieronymus, Kurz, and Lillo in Argentine and Patagonia, of Gay, Bertero, Philippi, and Skottsberg in Chile, of Sintenis, Eggers, and N. L. Britton and his collaborators in the West Indies, of Curtiss, Chapman, Small, Mohr, Harper, Garber, and O'Neill in the southeastern United States.

Some collectors have traveled far and wide and one can cite their specimens from many parts of the world. Standley, for instance, has brought back thousands of fine specimens from almost every Central American country. The United States South Pacific Exploring Expedition under Captain Wilkes brought back specimens of scores of species from almost every port at which it called in its world-wide itinerary, including Madeira, the Cape Verde islands, Brazil, Patagonia, Chile, Tahiti, Samoa, Wallis Island, Australia, Fiji, Hawaii, the Philippines, Borneo, Singapore, Cape of Good Hope, St. Helena, and western North America. That indefatigable and much-maligned proponent of strict priority in nomenclature, Otto Kuntze (1843—1907), collected wherever he went, and he seems to have covered most of the world in his travels—specimens of *Verbenaceae* were collected by him in the West Indies, Venezuela, Colombia, Panama, Costa Rica, the U. S. A., Japan, China, Cochin-china, Java, Siam, Burma, India, Aden, Egypt, the Canary Islands, Brazil, Uruguay, Argentina, Chile, Bolivia, Paraguay, Cape of Good Hope, Transvaal, Orange Free State, Natal, Mozambique, Tanganyika Territory, and Zanzibar. Other collectors have remained in one general area and botanized it thoroughly over many years, in all seasons, such as Deam in Indiana, E. J. Palmer and Demaree in the south-central states of the U. S. A., Mosier, Simpson, and Chapman in Florida, Duss in Martinique and Guadeloupe, Broadway in Trinidad, Conzatti in Mexico, A. G. Schulz in the Chaco.

Verbena yſern krut Cap. cccxciij.

Verbena uel herbena uel ſacra herba latine. grece gerebotamē vel periſterion. arabice alhea. Der meiſter Diaſcorides in dem capitel gerebotanum id eſt verbena beſchriber vns vnd ſpricht daz der ſy zweyerhand. Eyns wechſet kromp. das ander flecht Das erſte nennet pitagoras zů latin Centrum galli vnd die wechſet kromp. Die ander nēnet man zů latin gallanacia oder verbena. diſſe

Page from the 1485 edition of "Hortus Sanitatis Deutsch," by Johann von Cube [= Johann Wonnecke], printed by Peter Schoffer in Mainz, showing an easily recognizable illustration of **Verbena officinalis** L.
Plate 7

The fact that our census for Mexico is so high is certainly due in large part to the fine collecting of a large group of famous collectors over many years, including Edward Palmer, Pringle, Bourgeau, Gaumer, M. E. Jones, Gentry, Schaffner, Galeotti, Brandegee, Schiede, Hinton, Sessé, Mocino, Shreve, Orcutt, Wiggins, Stanford, Retherford, Northcraft, Arsène, Deppe, Purpus, M. T. Edwards, Gonzalez Ortega, Mueller, and Langlassé. Similarly, our knowledge of the Chinese flora is based in large part on the famous collections of Henry and Wilson and, in more recent years, on those of F. N. Meyer, Chang, Chun, Pi, Wu, Ying, Tak, and Tso.

As we shall see in subsequent papers, the *Verbenaceae* and related groups are quite important economically. Four hundred and twenty-two species and varieties are cultivated, either for food, lumber, hedges, medicines, or for other commercial purposes. We are most deeply indebted to C. F. Baker, L. H. Bailey, and Alfred Rehder for their collecting of cultivated material and for their exhaustive treatments of the cultivated members of the group.

The *Verbenaceae* and *Avicenniaceae* extend far back in geologic history. For our knowledge of the paleobotanic aspects of these groups we are indebted chiefly to Berry [133], Englehardt [134], Ettingshausen [135], Klotzsch [136], Friedrich [137], A. Braun [138], Potbury [139], Massalongo [140], Gardner [141], Menzel [136], C. and E. M. Reid [142], O. M. Ball [143], Velenovský [144], Hollick [145], Gaubin [146], and Tornabene [147]. The oldest known fossil member of these groups is *Vitex pentadactyla* from the Cretaceous of Bohemia, about 5,500,000 years old. Early Tertiary species are *Clerodendrum europaeum* from England and *Vitex pentamera* from Germany. Eocene species (3,000,000 years old) are *Avicennia eocenica* from Tennessee, *A. nitidaformis* of Mississippi, *Citharexylum eolignitícum* of Mississippi, *C. brazosense* of Texas, and *Premna Drummondii* of Tasmania. *Petrea rotunda* is a species from the Eocene or lower Oligocene of California. From the Oligocene (2,000,000 years old) we have *Citharexylum forsithiaefolium* of Italy, *Clerodendrum latifolium* of Germany, and *C. serratifolium* of Germany. From the Miocene (1,000,000 years old) we know *Duranta veringensis* of Switzerland, *Petrea borealis* of Czechoslovakia, *Verbenophyllum aculeatum* of Germany, and *Vitex Lobkowitzii* of Bohemia. In the Pliocene of Belgium has been found our present-day European species, *Verbena officinalis,* which is thus about 700,000 years old and is the earliest record of a living species in the group. Of similar age in France is a fossil which may possibly represent the present-day *Clerodendrum serratum.* From the Pleistocene, however, we know the living species *Clerodendrum Thomasii* and *Vitex Doniana,* both from Cameroons formations and both now still inhabiting Africa, and *Avicennia nitida* from Trinidad, as well as the extinct species *Clerodendrum robustum,* also from Cameroons. *Citharexylum retiforme* is a fossil species from the Tertiary of Colombia. *Vitex Agnus-castus* has also been unearthed in geological formations of recent age in Italy.

In their general aspect or habit the members of these groups exhibit almost every imaginable variation. In size they vary from prostrate herbs like *Verbena supina* of the desert regions of the Mediterranean area and Asia Minor and *V. Hayekii* and *V. Weberbaueri* of the high Andes and certain members of the genus *Phyla,* like *P. subterranea* of the Peruvian desert of Arequipa, to tall trees like Asiatic *Tectona grandis,* which grows to 165 feet tall, and Brazilian *Vitex excelsa,* which attains a height of 200 feet. The leaves are mostly opposite, decussate, and simple, but in some few genera like *Amasonia* and *Dipyrena* they are alternate, while in *Vitex* they are mostly palmately compound, in *Peronema* pinnately compound, and in *Petitia* (and some species and varieties of *Vitex)* unifoliolate. The leaves in some of the xerophytic desert groups like *Acantholippia* are almost microscopic and scale-like, while in *Tectona* they may attain a length of 3 feet and a width of a foot and a half. Sometimes they are entire, sometimes dentate, serrate, sinuate, or variously lobed, occasionally revolute or bullate. In *Aegiphila membranacea* they are so thin and fragile that one seldom can find a fully preserved leaf on a herbarium specimen, while in *Aegiphila racemosa, Citharexylum argutedentatum, C. Schulzii,* and *C. crassifolium* they are leathery-coriaceous. In some species of *Callicarpa* and *Clerodendrum* the lower surface is covered with shimmering golden scales, sometimes glandular-punctate. Occasionally the pubescence is stellate, sometimes furfuraceous or farinose. *Neosparton* has *Ephedra*-like practically leafless branches, while in *Diostea* the small leaves are quickly shed by the *Juncus*-like plants when moisture becomes scarce.

The genus *Avicennia* is characteristic of the salt-water mangrove swamps and lagoons and produces typical mangrove pneumatophores. Some members of the genus *Clerodendrum* (e. g., *C. inerme* and *C. aculeatum)* and *Vitex* (e. g., *V. trifolia* var. *simplicifolia)* are characteristic sand-dune and strand plants, occasionally also found in salt-water swamps. Some races of *Phyla nodiflora* are partially alkali-resistant. Most of the members of the *Stilbaceae* and *Selaginaceae* are decidedly heath-like shrubs or subshrubs. The genera *Acantholippia, Junellia, Kalaharia, Lampaya, Diostea, Neosparton, Dipyrena, Parodianthus, Urbania,* and *Thryothamnus* are typically xerophytic plants, inhabiting dry and desert regions or high alpine areas. Some of the alpine groups ascend to very high altitudes in the South American Andes. For instance, *Junellia aspera* ascends to 10,170 feet in Peru and to 14,107 feet in Chile [148], *J. seriphioides* to 11,482 feet in Argentina and to 13,132 feet in Peru, *J. bryoides* to 12,000 feet in Chile, *J. bisulcata* to 12,139 feet in Bolivia, *J. minima* to 12,500 feet in Peru and 12,631 feet in Bolivia, *J. uniflora* to 14,763 feet in Chile, *J. caespitosa* to 14,115 feet in Chile, *J. Hayekii* to 14,435 feet in Peru and 14,763 feet in Argentina, and *J. digitata* to 16,076 feet in Argentina. Certain other not typically xerophytic genera, however, also sometimes ascend to amazing altitudes. *Verbena Gooddingii,* for instance, ascends to 6650 feet in Arizona and grows at altitudes of 5000 to 6000 feet in Nevada and *V. bracteata* ascends to 6500 feet in Utah, 6900 in Colorado, and 7400 in New Mexico. In

Mexico *Lantana hispida* and *Vitex mollis* ascend to at least 5000 feet, *Stachytarpheta acuminata* to 5500, *Lantana achyranthifolia* to 6000, *L. hirta* to 6200, *Verbena gracilis* and *V. menthaefolia* to 7300, *V. canescens* to 7381, *V. bipinnatifida, V. litoralis, V. carolina,* and *V. neomexicana* var. *xylopoda* to 7500, *V. elegans* to 9500, *V. pinetorum* to 9842, *V. recta* to 10,000, and *V. teucriifolia* to 12,000 feet. In Guatemala *Lantana hirta* ascends to at least 8858 and in Costa Rica to 7874 feet. In Colombia *Duranta Mutisii* and *Aegiphila Killipii* have been collected at 9842 feet and *A. bogotensis* at 12,007 feet. In Bolivia *Lantana fucata* is found at 6000 feet, *Citharexylum andinum* at 8858, *Aloysia scorodonioides* at 10,000, *Verbena microphylla* at 13,132, and *V. hispida* at 15,748 feet. In Ecuador *Duranta triacantha* grows at 9842 feet, *Aegiphila ferruginea* at 10,498, *Citharexylum ilicifolium* at 11,000, and *Duranta Mandoni* at 11,811 feet. In Peru *Citharexylum flexuosum* has been found at 8500 feet, *Verbena clavata* at 9514, *Citharexylum argutedentatum* at 9842, *C. flexuosum* var. *subglabrum* and *Duranta Mandoni* at 11,482, *D. armata* at 11,811, *Verbena Weberbaueri* at 12,139, *V. Hayekii* at 13,000, *Citharexylum Herrerae* at 13,123 feet, and *Lantana Haughtii* at 17,000 feet. In Chile *Verbena origenes* ascends to 11,482 feet. On the other hand, *Phyla incisa* grows 185 feet below sea level in the Salton Basin of southern California and *Verbena officinalis* and *Vitex Agnus-castus* grow 1300 feet below sea level along the shores of the Dead Sea in Palestine.

Xerophytic species of *Junellia* on the deserts and on the high Andes of South America are often beautifully cespitose or rosulate and matted, with thick gnarled woody stems (attesting to considerable age) procumbent on the ground or practically so, with woody roots extending deep into the soil (in *J. bryoides* reported as penetrating to at least 9 feet underground), and showy verbena-like flowers. Some species are armed with sharply spinose leaves, twigs, and branches. Members of the genus *Acantholippia* are also armed with spinose twigs and branches. In *Lantana horrida, L. scorta,* and certain other species of that genus the stems and twigs are abundantly armed (at least in some forms) with strongly recurved and very sharp prickles, which in *L. Camara* var. *aculeata* and some other species serve as a means of support for the elongate, but weak and scrambling or semi-climbing stems. In *Clerodendrum aculeatum* the lower part of the petioles becomes modified into sharp spreading or recurved thorns. In *Baillonia* the leaf-scars are borne on conspicuous spreading or ascending sterigmata which bear a long beak-like projection on their abaxial side and which becomes hardened into a sharp spine after the leaves have fallen. Numerous species of *Duranta* are more or less spinose, the spines sometimes branched.

Plate 8. Myrmecophily in the *Verbenaceae:* 1. Flowering branch of *Clerodendrum formicarum,* showing ant homes in the swollen petioles; 2. Branch of *Clerodendrum fistulosum,* showing ant homes in the swollen internodes, the lower internode slit open to show the hollow interior; 3. Flowering branch of *Clerodendrum fistulosum,* showing the small circular openings to the ant homes just below the nodes. All figures reduced to 0.45 natural size. Drawn by Lucille E. Kopp.

Plate 8 Myrmecophily in the **Verbenaceae** (See opposite page for details.)

Epiphytes are rare, but do occur in the group, for example, *Clerodendrum epiphyticum* of Costa Rica and Panama, *Geunsia flavida* of the Philippines, and *Premna parasitica* of Burma, the Andaman Islands, Perak, Java, and Celebes. Myrmecophily is exhibited by at least three members of the genus *Clerodendrum* and one species of *Vitex*. In *Clerodendrum formicarum* of the Anglo-Egyptian Sudan, Gold Coast, Southern Nigeria, Cameroons, Spanish Guinea, Belgian Congo, Angola, and Southern Rhodesia ants of the widespread plant-inhabiting genus *Crematogaster* live in swellings in the short verticillate petioles [149]. In *C. myrmecophila* and *C. fistulosum*—the former native to the Federated Malay States, Java and Borneo and the latter to Sarawak and Borneo—the elongated internodes are swollen and provide shelter for the ants[150]. In *C. myrmecophila* the ants are of the genus *Pheidole*, in *C. fistulosum* they are the specific *Colobopsis clerodendri*. In *Vitex thyrsiflora* of French Guinea, Ivory Coast, Togoland, Nigeria, Cameroons, and Portuguese East Africa the ants live in the branches[151].

Numerous species which will be described in more detail later bear fragrant leaves or flowers, but a few are ill-scented or even fetid (e. g., *Aegiphila graveolens, A. mollis, Premna foetida, P. nauseosa, Clerodendrum Bungei)*. In pubescence members of the group vary from completely glabrous to variously pubescent, strigose, velutinous (e. g., *Aegiphila velutinosa)*, hirsute, hispid and villose, or even setose. Sometimes they are so very densely villous as to resemble plants like *Verbascum thapsus* (e. g., *Aegiphila villosissima, A. lanata, Lachnostachys, Newcastlia, Mallophora)*.

PART II.

"In tracing the progress of human knowledge through its several gradations of improvement, it is scarcely possible . . . not to feel an ardent wish of information relating to those persons by whom those improvements have severally been given: and hence arises that interesting sympathy which almost inseparably connects biography with the history of each respective branch of knowledge." [152] Although these words were written one hundred and fifty years ago, when the sum total of human knowledge was but a fraction of what it is today, they still ring true. It will, therefore, perhaps be of some general interest to present herewith a list of the men and women whose contributions have been so great,

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Plate 9. Armature in the *Verbenaceae:* 1. Branch of *Lantana scorta*, 0.45 natural size; 2. Section of stem of same, 0.90 natural size; 3. Branch of *Duranta orida* var. *domingensis*. 0.45 natural size; 4. Section of same, 0.90 natural size, showing branched thorns; 5. Fruiting branch of *Junellia bryoides*, 0.45 natural size; 6. A single fruiting-calyx, x1.8, showing spinose teeth; 7. A single leaf and bud, x1.8, showing the spine-like lobes; 8. Leafy twig of *Baillonia amabilis*, 0.45 natural size; 9. Section of same, x1.8, showing spine-tipped sterigmata; 10. Leafy branch of *Clerodendrum aculeatum*, 0.45 natural size; 11. Section of same, x1.8, showing spinose persistent petiole-base. Drawn by Lucille E. Kopp.

Armature in the **Verbenaceae** (See opposite page for details.)

Plate 9

or whose influence, in one way or another, has been so pronounced on those who have worked in these groups, that genera, species, and varieties have been named in their honor within these families. In this day when our world needs so desperately to learn the lesson of universal human brotherhood and not only the desirability, but the absolute necessity of complete international cooperation if the race is to survive, it is significant to point out the many nationalities, races, colors, and creeds that are represented in this list of those whose memory has been considered worthy of commemoration in the scientific names that we use. To date 674 men and women have had plants dedicated to them in the *Verbenaceae* and *Avicenniaceae*. These men and women represent 48 nationalities in the following proportions (nationality here being based on place of birth) : Germany—156, England—104, United States of America—91, France—79, Belgium—24, Italy—24, Argentina—15, Australia—14, Switzerland—14, Scotland—14, Netherlands—12, Spain—12, Sweden—11, Russia—9, Portugal—7, Czechoslovakia—7, China—7, Denmark—7, Brazil—6, South Africa—6, Austria—7, Mexico—5, Eire—5, Chile—3, Costa Rica—3, Luxembourg—3, Canada—3, Japan—3, two each from Greece and Hungary, and one each from Armenia, Bolivia, British Honduras, Celebes, Colombia, Cuba, El Salvador, Finland, Latvia, New Zealand, Paraguay, Persia, Philippines, Poland, Réunion, Siam, Uruguay, and Wales.

Le Roy Abrams (1874—), contemporary American plant taxonomist, noted for his excellent work on the flora of western North America [*Verbena Abramsi*].

Giuseppe Acerbi (1773—1846), Italian consul-general in Egypt [*Clerodendrum Acerbianum, Volkameria Acerbiana*].

George Patrick Ahern (1859—), American forester, lieutenant colonel in the United States army, noted for his work on tropical, especially Philippine, forestry [*Teijsmanniodendron Ahernianum, Vitex Ahernianum*].

Enrico A. d'Albertis (1846—1933), Italian explorer in the Pacific region [*Faradaya Albertisii*].

Fernando Altamirano (1850—1908), Mexican scientist and director of the National Medical Institute in Mexico City [*Citharexylum Altamiranum*].

Cárlos Ameghino (1865—1936), Argentinian geologist and paleontologist, director of the natural history museum at Buenos Aires, collected in Patagonia [*Junellia Ameghinoi, Verbena Ameghinoi*].

Édouard François André (1840—1911), noted French explorer and collector in Colombia and Ecuador [*Petrea Andrei*].

G. Andrieux, early plant collector in Mexico, about whom very little is known [*Verbena Andriaei, V. Andrieuxii*].

George Anson (1697—1762), English traveler and explorer, referred to as "Thomas Amason" in error by some authors [*Amasonia*].

Carl Ferdinand Appun (1820—1872), German explorer and collector in Venezuela and on Mount Roraima of "The Lost World" fame [*Vitex Appuni*].

Richard Archbold (1907—), contemporary American explorer in Madagascar and leader of several expeditions to New Guinea [*Archoldia*].

José Arechavaleta (1838—1912), famous Spanish botanist noted for his work on the plants of Uruguay [*Lippia Arechavaletae*].

Aubert Aubert du Petit-Thouars (1758—1831), famous French taxonomist and botanical writer of distinction [*Halodendron Thouarsi*].[154]

Jean Baptiste Christophe Fusée Aublet (1720—1778), famous French botanical collector and author of the flora of French Guiana [*Aubletia, Glandularia Aubletia, Obletia, Verbena Aubletia*].

Liberty Hyde Bailey (1858—), contemporary American botanist of great distinction, famous for his work on *Carex*, *Rubus*, palms, and cultivated plants [*Verbena Baileyana*].

Henri Ernst Baillon (1827—1895), distinguished French scientist and botanical author, editor of "Adansonia" [*Baillonia*].

Charles Fuller Baker (1872—1927), American botanist and plant collector in Cuba, Nicaragua, Brazil, Ceylon, and various parts of the United States [*Vitex polygama* var. *Bakeri*].

John Gilbert Baker (1834—1920), famous English worker on the flora of tropical Africa [*Clerodendrum Bakeri, C. Schweinfurthii* var. *Bakeri, Vitex Bakeri*].

Benedict Balansa (1825—1891), distinguished French collector in Paraguay, New Caledonia, Tonkin, and the Orient [*Gmelina Balansae, Lantana Balansae, Lippia Balansae, Oxera Balansae, Premna Balansae, Verbena Balansae*].

Giovanni Battista Balbis (1765—1831), Italian professor of botany at Turin, author of numerous scientific works [*Vitex Balbisii*].

Ernst Gottfried Baldinger (1738—1804), early German botanist [*Baldingera*].

Sir Isaac Bayley Balfour (1853—1922), noted Scottish horticulturist [*Clerodendrum Balfouri, C. Thomsoni* var. *Balfouri*].

Edward K. Balls, contemporary English collector in Argentina, Mexico, the Balkans, and other parts of Europe [*Verbena Ballsii*].

Miguel Bang, contemporary Bolivian collector who collected in Bolivia for Rusby and about whom not much is known [*Aegiphila Bangii, Lantana Bangii*].

Richard Baron (1847—1907), English missionary, botanist, and geologist in Madagascar, died there of malaria and blackwater fever [*Clerodendrum Baronianum*].

Charles Barter (?—1859), English horticulturist, gardner at Kew, explorer in Nigeria, of whom Hooker said[155] "an intrepid and indefatigable discoverer, whose collections far exceed in magnitude, condition, and value those of any other explorer in those regions," died in west Africa [*Clerodendrum Barteri*].

Friedrich Gottlieb Bartling (1798-1875), German professor of botany at Göttingen [*Chloanthes Bartlingii, Pityrodia Bartlingii*].

H. Baum, German explorer in Angola about whom little is known [*Clerodendrum Baumii, Lippia Baumii, Vitex madiensis* var. *Baumii*].

Godfrey Herbert Beale, contemporary English geneticist and cytologist [*Verbena Bealei*].

Odoardo Beccari (1843—1920), distinguished Italian collector in Malaya and the East Indies, author, and expert on palms [*Geunsia Beccariana*].

George Bentham (1800—1884), famous English taxonomist and botanical author [*Duranta Benthami, Premna Benthamiana, Vitex Benthamiana*].

Joseph Charles Corneille Bequaert (1886—), Belgian collector in the Congo and elsewhere [*Clerodendrum Bequaerti, Vitex Bequaerti*].

Jean Louis Berlandier (?—1851), noted Belgian collector in Texas and northern Mexico, especially along the United States-Mexican boundary [*Citharexylum Berlandieri, Lippia Berlandieri*].

Bernier, French plant collector in Madagascar about whom little is known [*Clerodendrum Bernieri*].

Carlo Giuseppe Bertero (1789—1831), noted Italian collector in the Antilles, Colombia, Chile, and the Juan Fernandez Islands, died in a shipwreck in the south Pacific [*Aegiphila Berteriana, Citharexylum Berterii, Lippia Berterii, Verbena Berterii*].

Antonio Bertoloni (1775—1869), Italian professor of botany at Bologna [*Bertolonia*].

Paul Besson, Italian horticulturist of whom little is known [*Citharexylum Bessonianum*].

Ernst Betche (1851—1913), famous German collector in Samoa and New South Wales [*Oncinocalyx Betchei*].

Captain Bethune, English collector in Borneo about whom little is known [*Clerodendrum Bethuneanum*].

Peter Beveridge, noted Australian collector [*Dicrastylis Beveridgei*].

Patrick Blair (1677—1728), English physician in London and later in Boston, author of botanic essays [*Blairia*].

William Henry Blanchard (1850—1922), American botanist and educator, well-known for his work on *Rubus* and on New England plants [*Verbena Blanchardi*].

Jacques Samuel Blanchet (1807—1875), famous Swiss collector in Brazil for 30 years [*Petrea Blanchetiana, Vitex Blancheti*].

Francisco Manuel Blanco (1778—1845), famous Spanish collector and author of Philippine plants [*Callicarpa Blancoi, Clerodendrum Blancoi*].

Carl Ludwig von Blume (1796—1862), famous German director of the botanic garden at Batavia and author on the flora of Java [*Callicarpa Blumei, Clerodendrum Blumeanum*].

Émile Marie Bodinier (1842—1901), French missionary and botanical collector in China [*Callicarpa Bodinieri, Premna Bodinieri*].

Wenzel Bojer (1797—1856), noted Czechoslovakian collector in Mauritius, where he died [*Vitex Bojeri*].

Isaac Boldingh (1879—1938), well-known Dutch collector in the Netherlands West Indies [*Stachytarpheta Boldinghii*].

Aimé Jacques Alexandre Bonpland [né Goujaud] (1773—1858), famous French companion of Humboldt who later botanized by himself in Brazil, Paraguay, and Argentina; was once held captive in the interior of Paraguay for 9 years; died in Argentina [*Callicarpa Bonplandiana*].

Jacobus Bontius (1592—1631), early Dutch collector in Java, where he died [*Bontia*].

Peter Carl Bouché (1782—1856) and Carl David Bouché (1809—1881), two of a famous family of German scientists [*Bouchea*].

Harold Edmund Box (1898—), contemporary English collector in Antigua and elsewhere [*Ghinia Boxiana*].

Maria Louisa of Parma, of the House of Bourbon, Italian wife of King Charles IV of Spain (1751—1819) [*Aloysia*].

Eugène Bourgeau (1813—1877), noted French collector in Mexico, the Canary Islands, and the Balearic Islands [*Citharexylum Bourgeauianum*].

Leonard John Brass (1900—), well-known contemporary Australian collector in New Guinea, the Solomon Islands, and Africa [*Clerodendrum Brassii*].

Brenes (1890—), contemporary Costa Rican botanist of Swiss ancestry, has collected in Switzerland and is noted for his important collections of Costa Rican plants [*Lippia Brenesii*].

John Isaac Briquet (1870—1931), famous Swiss taxonomist, linguist, author, and expert on the *Verbenaceae* and *Lamiaceae* [*Lippia Briquetii, L. Briquetiana, Verbena Briquetii*].

Nathaniel Lord Britton (1859—1934), American systematist, founder of the New York Botanical Garden, famous for his work on the *Caesalpiniaceae, Mimosaceae, Cactaceae, Cyperaceae,* and the flora of eastern North America and the West Indies, a prolific collector in the West Indies [*Citharexylum Brittonii, C. fruticosum* var. *Brittonnii, Lantana Brittoni*].

Walter Elias Broadway (1863—1935), famous English collector in Tobago and Trinidad, where he died [*Citharexylum Broadwayi, Petrea arborea* var. *Broadwayi*].

Sir Charles Anthony Johnson Brooke [né Johnson] (1829—1917), second English rajah of Sarawak [*Clerodendrum Brookeanum, C. Brooksii*].

Ernst Wilhelm von Brűcke (1819—1892), German professor of physiology at Königsberg [*Brűckea*].

Paul Johannes Brűhl (1855—), German plant collector in Angola [*Bouchea pumila* var. *Brűhliana*].

Wilhelm Buch (1862—), German plant collector in Haiti [*Lantana Buchii*].

John Buchanan (1855—1896), distinguished English collector in central Africa [*Vitex Buchanani*].

George Conrad Bucher (1893—), American plant collector in Cuba [*Callicarpa Bucheri*].

Reinhold Buchholz (?—1876), German botanist and collector in the Cameroons [*Clerodendrum Buchholzii*].

Max Buchner (1846—1921), German explorer and collector in Africa [*Clerodendrum Buchneri, Vitex Buchneri*].

Otto Buchtien, German physician and distinguished collector in Bolivia [*Aegiphila Buchtienii*].

Heinrich Wilhelm Buek (1796—1879), German botanist, one of 3 famous Hamburg botanists of this surname [*Citharexylum Buekii*].

Alexander Andrejewitsch von Bunge (1803—1890), Russian collector in Altai, China, and Mongolia, and director of the botanic garden at Dorpat [*Clerodendrum Bungei*].

Joseph Bunny (1798—1885), English writer on the plants of Great Britain [*Bunnya, Cyanostegia Bunnyana*].

Ernst Friedrich Burchard, German writer on floral anatomy in 1741 [*Burcardia, Burchardia*].

John Burroughs (1837—1928), famous American naturalist, philosopher, poet, and literary author [*Burroughsia*].

Joachim Burser (1583—1639), German professor at Saröe, Denmark, and friend of Bauhin [*Burseria*].

Sir Richard Francis Burton (1821—1890), English explorer and collector in Africa [*Lippia Burtonii*].

Walter Carl Otto Busse (1865—1933), German plant collector in Tanganyika [*Clerodendrum pleiosciadium* var. *Bussei*].

Butayer (1858—1929), Belgian Jesuit missionary in the Congo where he collaborated with Gillet and died [*Clerodendrum capitatum* var. *Butayeri*].

Oscar Alexander Richard Bűttner (1858—), German traveler and collector in the Cameroons, Togo, Turkestan, Buchara, Transcaucasia, Turkey, and the United States [*Clerodendrum Bűttneri*].

Alphonse François Édouard Cabra (1862—1932), Belgian lieutenant general on the expedition of 1896 to the Congo, where he collected plants [*Clerodendrum Cabrae*].

Ángel Lulio Cabrera, prolific contemporary Argentinian botanist, famous for his valuable work on the flora of Argentina and Uruguay [*Lantana aristata* var. *Cabrerae, L. Cabrerae, Verbena Cabrerae*].

Salvador Calderón (1884—1940), distinguished Salvadorian collector and author on the flora of El Salvador [*Citharexylum Calderonii, Stachytarpheta Calderonii*].

Thomas Campbell, English horticulturist concerning whom not much is known [*Clerodendrum Campbellii*].

Augustin Pyramus de Candolle (1778—1841), one of 5 famous Swiss naturalists of this family [*Petrea Candolleana*].

Martin Cárdenas (1899—), Bolivian professor of botany at La Paz and noted collector in that country [*Ghinia Cardenasi*].

David Wynford Carnegie (1871—1900), English collector in Australia and Nigeria, where he died [*Dicrastylis Carnegiei*].

Rodriguez de Carvalho, Portuguese collector in Mozambique [*Vitex Carvalhi*].

Giovanni Casaretto (1812—1879), Italian writer on the plants of that land [*Casarettoa*].

Franz Peter Cassel (1784—1821), German professor of botany at Ghent [*Casselia*].

Juan de Dios Castel, Spanish companion of Loefling on his trip of exploration up the Orinoco, concerning whom not much is known [*Castelia*].

Alberto Castellanos, contemporary Argentinian botanist and collector in that country [*Aloysia Castellanosi, Lampaya Castellani*].

Pierre Julien Cavaleria (1869—), French missionary and collector in China [*Callicarpa Cavaleriei, Clerodendrum Cavaleriei, Premna Cavaleriei*].

Jean Chaffanjon (1854—1913), French missionary and plant collector in China and tropical America, died in Indochina [*Callicarpa Chaffanjoni*].

Ludolf Adalbert von Chamisso (1781—1838), born in France, driven to Germany by the French Revolution, became page to the Queen of Prussia, later teacher and botanist at Berlin, famous taxonomist, botanical writer, and author of German literary classics [*Citharexylum Chamissonis, Lantana Chamissionis, Lippia Chamissonis, Stachytarpheta Chamissonis, Verbena Chamissonis*].

Emile Chateau, French collector in Texas about whom little is known [*Lycium Chateaui*].

Léon Chenault (1853—1930), French horticulturist of note [*Callicarpa Chenaulti*].

Auguste J. B. Chevalier (1873—), French collector in Africa and Indochina [*Premna Chevalieri*].

Minton Asbury Chrysler (1871—), contemporary American educator, botanical author, and editor, collected in the Antilles, Central America, and elsewhere [*Vitex Chrysleriana*].

Kuan Kuang Chung [Kwang Kwong Ts'oong], Chinese professor of botany at Peiping [*Tsoongia*].

Leo de Cienkowski (1822—1887), Russian biologist, expert on bacteria, algae, and protozoa, collected plants in Nubia and Kordofan [*Vitex Cienkowskii*].

Jean Claessens (1873—), contemporary Belgian agronomist, director general of the ministry of colonies and of the Institut National pour l'Etude Agronomique de Congo Belge, collected plants in Belgian Congo in 1909 and 1910 [*Premna Claessensi*].

George Claraz (1832—1930), Swiss plant collector in Patagonia [*Lantana Clarazii*].

Charles Baron Clarke (1832—1906), distinguished English plant taxonomist, known for his work on sedges and the plants of India [*Vitex Clarkeana*].

Peter Clausen (?—1855), Danish plant collector, noted for his collections in Brazil, where he assumed the name "Pedro Claudio Dinamarquez"; died in an insane asylum in London [*Lippia Clausseni*].

W. Clifton, Australian collector noted for his work in New South Wales, but about whom little is known personally [*Lachnostachys Cliftoni*].

Elzaba Urseba Clover (1897—), American collector who did noteworthy botanizing in Texas [*Verbena Cloveri*].

Henry Thomas Colebrooke (1765—1837), noted English Sanskrit scholar, lived in India for 32 years, collected chiefly in Silhet [*Clerodendrum Colebrookianum*].

Marjorie Isabel Collins, Australian plant collector in New South Wales [*Premna Collinsae*].

Harold Frederick Comber (1897—), contemporary English horticulturist, collected plants and seeds in Tasmania, Argentina, and Chile, in the two latter countries mostly at altitudes of over 3,000 feet in the Andes [*Junellia Comberi, Verbena Comberi*].

Philibert Commerson (1727—1773), noted French botanical collector and explorer in South America, Asia, and Africa [*Clerodendrum Commersonii, Volkameria Commersonii*].

Robert Harold Compton (1886—), English plant collector in New Caledonia [*Oxera Comptonii*].

Conrad, German collector of plant material in Tanganyika in 1904, about whom very little is known [*Clerodendrum Schweinfurthii* var. *Conradii*].

George Proctor Cooper, III (1896—), contemporary Canadian forester, collected plants in Panama, Colombia, Costa Rica, Mexico, Liberia, Sierra Leone, the West Indies, and parts of the United States [*Citharexylum Cooperi, Vitex Cooperi*].

Anatole Corbisier-Balanot (1881—), Belgian botanist, collected plants in Belgian Congo, director of the botanical garden at Eala [*Clerodendrum Corbisieri*].

Marc Cornacchin, Italian professor of medicine at Pisa in the first half of the 17th century [*Cornacchinia*].

Jacques Philippe Cornuti (1600—1651), French physician and writer on Canadian plants [*Cornutia*].

Francisco Joaquim da Costa e Silva (1827—1899), Portuguese consul who facilitated the botanical exploration of the island of S. Thomé by Moller [*Clerodendrum Preussii* var. *Silvaeanum, C. Silvaeanum*].

M. Costello, Australian plant collector in Queensland [*Dicrastylis Costelloi*].

Thomas Coulter (1793—1843), Irish plant collector in California and Mexico [*Tetraclea Coulteri*].

Guillermo Covas (1915—), contemporary Argentinian botanist and educator, specialist on the systematics and improvement of forage plants and genetics of *Verbena* [*Verbena Covasii*].

Robert Craig (1847—1927); American horticulturist of Philadelphia [*Lantana Craigii*].

José Cuatrecasas Arumi (1903—), contemporary Spanish botanist of distinction, noted for his important collections of Colombian plants from unexplored parts of that country [*Aegiphila Cuatrecasasi*].

Hugh Cuming (1791-1865), distinguished English collector in South America, the Philippines, and other islands of the Pacific [*Callicarpa Cumingiana, C. pentandra var. Cumingiana, Clerodendrum Cumingianum, Geunsia Cumingiana, Lantana Cumingiana, Premna Cumingiana, Symphorema Cumingianum, Verbena Cumingii*].

Allan Cunningham (1791—1839), noted English collector in Brazil and Australia, where he died [*Clerodendrum Cunninghamii*].

Hugh McCollum Curran (1875—), American forester and collector in Venezuela and the Philippines [*Clerodendrum Curranii, Premna Curranii, Vitex Curranii*].

Anita G. Curtis, American collector in Angola and Congo [*Priva Curtisiae*].

Carlton Clarence Curtis (1862—1945), beloved American botanical educator and author, professor of botany at Columbia University [*Lippia Curtisiana*].

Charles Curtis (1853—1926), noted English collector in Madagascar, Malaya, Borneo, and Java [*Clerodendrum Curtisii*].

Moses Ashley Curtis (1808—1872), famous American collector in North Carolina [*Verbena Curtisii*].

John Dallachy (1820—1871), Scottish plant collector in Australia [*Premna Dallachyana*].

Kenneth Waring Dalrymple (1875—), contemporary New Zealand botanist [*Gmelina Dalrympleana*].

Charles Darwin (1809—1882), famous English naturalist on the voyage of the "Beagle" around the world in 1831—1836; establisher of the doctrine of organic evolution; crossed South America from Valparaiso to Buenos Aires and collected numerous plants [*Lippia Darwinii, Neosparton Darwini*].

Morley Thomas Dawe (1880—), English botanical collector in Colombia [*Citharexylum Dawei*].

Charles Clemon Deam (1865—), contemporary American botanist and forester, collected in Guatemala and Florida, famous for his work on the flora of Indiana [*Verbena Deamii*].

Debeerst, collector in Belgian Congo about whom little is known [*Clerodendrum Bequaerti* var. *Debeerstii, C. Wildemannianum* var. *Debeerstii*].

Otto Degener (1899—), contemporary American botanist and author, collected in various parts of the United States, the Bahamas, Fiji Islands, and especially Hawaii [*Verbena plicata* var. *Degeneri, Vitex Degeneriana*].

Dekindt, German plant collector in Angola [*Clerodendrum Dekindtii, Vitex Dekindtiana*].

Pierre Jean Marie Delavay (1834—1895), French missionary and botanical collector in China, where he died [*Gmelina Delavayana*].

Delzie Demaree (1889—), contemporary American botanist and ecologist, noted for his extensive collecting in the southern and southwestern states [*Verbena Demareei*].

Dempster, Australian plant collector about whom little is known [*Lachnostachys Dempsteri*].

Sir William Thomas Denison (1804—1871), English engineer, collector in Canada from 1827 to 1831, governor of Tasmania from 1847 to 1855 and of New South Wales from 1855 to 1861, a zealous patron of music, the arts, and science [*Denisonia*].

Ferdinand Deppe (?—1861), noted German plant collector in Mexico [*Aegiphila Deppeana*].

Haig Dermen (1895—), contemporary Armenian cytologist and geneticist, born in Turkey, now research associate at the Arnold Arboretum [*Verbena Dermeni*].

Robert Derry, English botanist and forester, collected extensively in Malacca, Perak, Penang, and Singapore [*Premna Derryana*].

Alfred Dewèvre (1866—1897), Belgian plant collector in Congo, where he died [*Vitex Dewevrei*].

Friedrich Ludwig Emil Diels (1874—1945), distinguished German plant taxonomist, director of the botanical garden at Berlin, collected plants in Ecuador [*Callicarpa Dielsii*].

Max Julius Dinklage (1864—1935), noteworthy German plant collector in the Cameroons and Liberia [*Clerodendrum Dinklagei, Vitex Dinklagei*].

Kurt Dinter (1868—), German plant collector, noted for his collections in Southwest Africa [*Clerodendrum Dekindtii* var. *Dinteri*].

Will A. Dixon, Australian plant collector in New South Wales [*Newcastlia Dixoni*].

Denis Dodart (1634—1707), French physician to King Louis XIV, known for his study of plants by chemical analyses [*Denisaea, Denisia, Deniseia*].

Joseph Dombey (1742—1796), early French explorer and collector in Chile and Peru [*Duranta Dombeyana*].

David Don (1799—1841), famous English horticulturist and author [*Vitex Doniana*].

Vitaliano Donati (1713—1763), Italian naturalist, botanized in southeastern Europe, Asia Minor, and Egypt, murdered after a shipwreck on his return from Egypt [*Donatia*].

Paul Louis Dop (1876—), distinguished French botanist, famous for his work on the *Verbenaceae* of Indochina [*Premna Dopii*].

Philipp Doran, Australian botanist, director of the botanic garden at Castlemaine, Victoria [*Dicrostylis Doranii*].

James Douglas (1675—1742), Scottish lithographer and author [*Douglassia*].

James Drummond (1784—1863), Scottish plant collector in Ireland and western Australia [*Pityrodia Drummondii, Premna Drummondi*].

Thomas Drummond (1780—1835), Scottish plant collector of considerable fame, brother of the preceding, collected in Canada and the United States, died in Cuba [*Glandularia Drummondii, Verbena Aubletia* var. *Drummondii, V. canadensis* var. *Drummondii, V. Drummondii*].

Editha Ida Dryander, née Chateau (1874—), contemporary Austrian botanical collector, born in Germany (father a Canadian Huguenot), collected in the Balkans and more recently in Colombia, where she now resides [*Citharexylum Dryanderae*].

Adolfo Ducke, distinguished contemporary Swiss botanist, noted for his extensive collections in Brazil, Guiana, and Colombia, especially the region of the Amazon, and his important botanical writings on that region [*Aegiphila Duckei, Clerodendrum Duckei, Petrea Duckei, Vitex Duckei*].

François Ducloux (1864—), French missionary and collector in China [*Vitex Duclouxi*].

Richard Arnold Dummer [né Dűmmer] (1887—1922), South African plant collector in Uganda and Kenya [*Clerodendrum discolor* var *Dummeri*].

Edward John Dunn (1844—1937), noted English plant collector in northern Australia [*Callicarpa Dunniana*].

P. R. Dupont, French curator of the botanical station on the Seychelles Islands [*Nesogenes Dupontii*].

Castore Durante (1529—1590), Italian physician in Rome and author [*Castorea, Duranta*].

Per Karl Hjalmar Dusén (1855—1926), excellent Swedish plant collector in Cameroons, Patagonia, Greenland, Brazil, and Chile [*Aloysia Dusenii, Clerodendrum Dusenii, Vitex polygama* var. *Dusenii*].

Jacques Louis Raoul Duval, Comte d'Epremesnil (1827—1891), French scientist, chevalier of the Legion d'Honneur, one of the founders of the Société d'Acclimation [*Chloanthes Depremesnilii, Depremesnilia, Pityrodia Depremesnilii*].

Philippe Albert Eberhardt (1874—1942), French botanist, professor of botany at the university of Besançon, collected plants in Indochina from 1905 to 1908 [*Vitex Eberhardtii*].

Saile Echegary, noted Argentinian collector, famed for his work on the plants of San Juan and Córdoba [*Junellia Echegarayi, Verbena Echegarayi*].

Heinrich Karl Daniel Eggert (1841—1904), famous German collector in various parts of central United States [*Verbena simplex* var. *Eggerti*].

Carl August Ehrenberg (1801—1849), noted German plant collector in Mexico and the West Indies [*Bouchea Ehrenbergii, Verbena canadensis* var. *Ehrenbergii, V. Ehrenbergiana*].

Erik Leonard Ekman (1883—1931), famous Swedish plant collector in Argentina, Cuba, and Hispaniola, died in the Dominican Republic [*Citharexylum Ekmani, Clerodendrum Ekmani, Petitia domingensis* var. *Ekmani*].

Hetta Elbert, German wife of the following, who faithfully accompanied and assisted him in his collecting on the Lesser Sunda Islands [*Clerodendrum Hettae*].

Johannes Eugen Wilhelm Elbert (1878—1915), German plant collector in the Sunda Islands [*Clerodendrum Elberti*].

Elder, Australian plant collector about whom little is known [*Chloanthes Elderi, Hemiphora Elderi*].

John Ellis (1710—1776), English merchant and zoologist, importer of American seeds, and correspondent of Linné [*Duranta Ellisia, Ellisia*].

Adolph Daniel Edward Elmer (1870—1942), American, extensive collector in the western United States and the Philippines [*Clerodendrum Elmeri, Petraeovitex Elmeri*].

Octave Adrien Jean Elskens (1879—1935), Belgian diplomat in the colonial service and agricultural agent, collected plants in Belgian Congo [*Premna Elskensi*].

George Monroe Emrick (?—1906), American physician and plant collector who made 3 or 4 trips to Mexico from 1901 to 1906 and collected several hundred plants there, friend of Millspaugh [*Citharexylum Emrickianum*].

Rudolf Endlich (?—1915), noted German collector, botanized in Paraguay, Brazil, Mexico, Asia Minor, and tropical Africa [*Citharexylum Endlichii, C. Rugendasii* var. *Endlichii*].

George Engelmann (1809—1884), German physician, traveled and collected widely in the United States [*Verbena Engelmannii*].

Christian Friedrich Ludwig Cachand Ervendberg (1809—1863), ill-starred heroic German Lutheran clergyman, educator, and agriculturist, whose life story forms one of the most fascinatingly pathetic chapters in the history of the American frontier, collected plants in Texas and Mexico, where he was murdered by bandits [*Bouchea Ervendbergii*].

Joseph Henri Esquirol (1870—), French missionary and botanical collector in China [*Callicarpa Esquirolii, Clerodendrum Esquirolii, Pavetta Esquirolii*].

George Eyles (1815—1887), English horticulturist, collected plants in Africa [*Vitex Eylesii*].

Michael Faraday (1791—1867), world famous English chemist and physicist [*Faradaya*].

Paul Guillaume Fargas (1844—1912), French missionary and botanical collector in China, where he died [*Clerodendrum Fargesii, C. trichotomum* var. *Fargesii*].

Friedrich Karl Georg Fedde (1873—1942), well known German botanist and editor [*Callicarpa Feddei*].

August Fendler (1813—1883), famous German plant collector, made important collections in various parts of the United States, Trinidad, Panama, and Venezuela, died in Trinidad [*Aegiphila Fendleri*].

Karl Fiebrig-Gertz (1869—), German botanist who made noteworthy plant collections in Paraguay [*Aloysia Fiebrigii, Lantana Fiebrigii, Lippia Fiebrigii*].

Achille Eugène Finet (1863—1913), French botanical collector in Indochina and other parts of eastern Asia [*Clerodendrum Finetii*].

George Finlayson (1790—1823), Scottish plant collector in Ceylon, Bengal, and Siam, died at Calcutta [*Gmelina Finlaysoniana, Vitex Finlaysoniana*].

Gustav Adolf Fischer (?—1886), German physician in Zanzibar, collected extensively in eastern Africa [*Clerodendrum Fischeri, Vitex Fischeri*].

Leopold Heinrich Fisher (1817—1886), German horticulturist [*Duranta Fischeri, Timotocia integrifolia* var. *Fischeri*].

H. R. Fletcher, contemporary English botanist, noted for his work on the plants of Siam [*Duranta Fletcheriana*].

Francis Fleury (1882—1919), Belgian forester of distinction, noted for his work on the forest flora of Ivory Coast, French Guinea, Senegal, Soudan, Dahomey, Gabun, Cameroons, and Indo-china, in all of which lands he collected extensively; died at sea at the entrance of the Red Sea [*Clerodendrum Fleuryi*].

Amelius Macer Floridus (?—16 B.C.), Roman naturalist who wrote about birds, snakes, and medicinal plants and was quoted by Ovid [*Maceria*].

Franz Fonck (1830—1912), German physician and explorer in western Patagonia, author of numerous important works on medicine, geography, and history, made extensive botanical collections studied by Philippi; his name is often inaccurately given as "Francisco Fonk" [*Aloysia Fonckii, Lippia Fonckii*].

Francis Blackwell Forbes (1839—1908), American naturalist, collected extensively in China [*Clerodendrum Colebrookianum* var. *Forbesii, Congea Forbesii*].

Charles Ford (1844—1927), noted English botanical collector in Hongkong and China [*Premna Fordii*].

George Forrest (1873—1932), Scottish plant collector, well-known for his explorations in China and Tibet [*Caryopteris Forresti*].

Pehr Forskål (1732—1763), ill-starred Finnish botanist, noted for his explorations in Egypt and Arabia, where, after repeated encounters with bandits who robbed him of everything except the clothes he wore and his "worthless" plants and treacherous desertion on the desert by his Arab guides, he died of starvation and exposure; after death even his coffin and the shrouds in which he was wrapped were stolen by bandits [*Priva adhaerens* var. *Forskalii, P. Forskalii, Verbena Forskalii*].

Jean Joseph Fortunat (1875—), contemporary French missionary and botanical collector in China since 1899 [*Premna Fortunati*].

Robert Fortune (1812—1880), English botanical explorer, collected in China and Java [*Clerodendrum Fortunei*].

E. W. Foster, English plant collector in Southern Nigeria about whom little is known [*Vitex Fosteri*].

Alexander von Frantzius (?—1877), Bavarian physician, authority on the climate and ornithology of Costa Rica [*Stachytarpheta Frantzii*].

Emanuel von Friedrichsthal (1809—1842), German plant collector, botanized in central Europe, Central America, and the island of St. Thomas [*Stachytarpheta Friedrichsthalii*].

Theodor Magnus Fries (1832—1913), famous Swedish botanist, one of 13 scientists of the same surname and mostly related [*Clerodendrum Friesii*].

Ricardo de Lemos Froes (188?—), contemporary Brazilian plant collector [*Vitex Froesii*].

Ernest Edward Galpin (1858—), noted South African plant collector, made important collections in the Cape of Good Hope area [*Lantana Galpiniana*].

George Gardner (1812—1849), famous Scottish plant collector in Brazil, where he discovered hundreds of new species; died in Ceylon [*Lippia Gardneriana, Stachytarpheta Gardneriana, Vitex Gardneriana*].

H. B. G. Garrett, English plant collector in Siam concerning whom little is known [*Clerodendrum Garrettianum, Garrettia, Premna Garrettii*].

Charles Gaudichaud-Beaupré (1789—1854), famous French naturalist, made two collecting trips around the world, including one on the famous "Bounty" [*Clerodendrum Gaudichaudii, Premna Gaudichaudii, Verbena officinalis* var. *Gaudichaudii*].

George Franklin Gaumer (1850—1929), distinguished American collector in Yucatán and Honduras, from which areas he brought valuable collections [*Vitex Gaumeri*].

Augusto Gehrt, contemporary Brazilian collector [*Lippia Gehrtii*].

Wilhelm ["*Guillermo*"] Geisse (1846—1925), German pharmaceuticist who collected plants in various parts of Chile [*Lippia Geisseana*].

Howard Scott Gentry, American naturalist and anthropologist, made very noteworthy plant collections in Mexico [*Lippia Gentryi, Verbena Gentryi*].

Geoffray, French customs official and botanical collector in Indochina from 1904 to 1907 about whom little else is known [*Clerodendrum Geoffrayi*].

Philibert Germain (1827—?), French entomologist, collected insects and plants in Chile [*Citharexylum Germaini*].

Frederick von Gerolt (1797—1879), German baron, diplomat, and mineralogist, consul-general in Mexico, minister to Washington, made two expeditions up Mt. Popocatepetl in 1833 and 1834, wrote on the mineralogy, geology, and physical geography of Mexico [*Lantana Geroldiana*].

Steven Jan van Geuns (1767—1795), Dutch writer on Belgian plants [*Geunsia*].

Auguste Boniface Ghiesbreght (1810—1893), Belgian plant collector in Mexico, where he died [*Citharexylum Ghiesbreghtii*].

Luca Ghini (1500—1556), Italian botanist, founder of the botanical gardens at Padua and Pisa [*Ghinia*].

William Ernest Powell Giles (1847—1894), English plant collector in Australia [*Dicrastylis Gilesii*].

Justin Gillet (1866—1943), Belgian Jesuit missionary, founder of the botanical garden at Kisantu, collected extensively in the Belgian Congo, where he died [*Clerodendrum Giletii, Vitex congolensis* var. *Gilletii, V. Gilletii*].

Jan Bevington Gillett (1911—), contemporary English botanist, collected plants in South Africa, Rhodesia, British Somaliland, and eastern Abyssinia [*Chascanum Gillettii*].

Stephane de Giorgi (1879—), Italian agriculturist, chief of the Belgian agricultural department to 1924 [*Vitex Giorgi*].

Giuseppe Giraldi (?—1900), Italian missionary and plant collector in China, where he died [*Callicarpa Bodinieri* var. *Giraldii, C. Giraldii*].

Auguste François Marie Glaziou (1828—1906), famous French botanical collector in Brazil, where he collected thousands of valuable specimens, including many new species [*Aegiphila Glazioviana, Citharexylum Glaziovii, Lantana Glaziovii, Lippia Glazioviana, Petrea Glaziovii, Stachytarpheta Glazioviana, Timotocia Glaziovii, Vitex polygama* var. *Glaziovii*].

Henry Allan Gleason (1882—), distinguished American taxonomist and ecologist, collected in British Guiana and various parts of the United States, traveled in Europe, Java, etc. [*Aegiphila Gleasonii, Citharexylum Gleasonianum*].

Johann Georg Gmelin (1709—1755), German professor of botany at Leningrad, famed for his work on Siberian plants; there were 15 well-known botanists named Gmelin [*Gmelina*].

Alexandre Godefroy-Lebeuf (1852—1903), French botanical collector in Indochina [*Clerodendrum Godefroyi*].

Emil August Goeldi (1859—1917), Swiss botanist and plant collector in Amazonian Brazil [*Aegiphila Goeldiana*].

Walter Goetze (?—1899), German plant collector in Africa, died in Tanganyika [*Vitex Goetzei*].

Leslie Newton Goodding (1880—), American botanist, collector in and author of works on the flora of the southwestern United States and Rocky Mountains [*Verbena bipinnatifida* var. *Gooddingii, V. Gooddingii*].

Goossens (1896—), contemporary Orange Free State botanist who has collected extensively in South Africa, author of several textbooks of botany and a dictionary of botanic terms in Afrikaans [*Clerodendrum Goossensii*].

Arthur John Lewis Gordon (1847—1918), English private secretary to Sir A. C. Hamilton-Gordon when the latter was governor of Fiji from 1868 to 1880 [*Clerodendrum Gordoni*].

Göring, German plant collector in Japan about whom little is known [*Premna Göringii*].

John Gossweiler, Swiss botanist, recognized authority on the flora of Angola and Portuguese Congo [*Clerodendrum Gossweileri, Lippia Gossweileri, Vitex Guerkeana* var. *Gossweileri, V. madiensis* var. *Gossweileri*].

Justin Goudot, famed Belgian plant collector in Venezuela and Colombia from 1822 to 1842 [*Aegiphila Goudotiana*].

Alfred Grandidier (1836—1921), French geographer, anthropologist, linguist, and explorer, traveled all over the world, collected plants in Bolivia, India, Ceylon, Zanzibar, and Madagascar [*Vitex Grandidiana*].

Josiah Gregg (1806—1850), American plant collector on the great prairies of the western United States, in New Mexico, and Mexico; died in the wilderness of northern California [*Lippia Greggii*].

Sir George Grey (1812—1898), English plant collector, born in Portugal, botanized in Africa, Australia, and New Zealand [*Clerodendrum Greyi*].

William Griffith (1810—1845), famous English botanical collector in Assam, Bhutan, India, Afghanistan, and Burma, died in Malacca [*Callicarpa macrophylla* var. *Griffithii, Clerodendrum Griffithianum, Sphenodesme Griffithianum*].

August Heinrich Rudolf Grisebach (1814—1879), distinguished German plant taxonomist, noted especially for his work on the plants of Argentina and the British West Indies [*Callicarpa Grisebachii, Lippia Grisebachiana, L. Grisebachii*].

Robert Louis August Max Gűrke (1854—1911), distinguished German botanist, authority on many groups of European, American, and African plants [*Clerodendrum Guerkei, Vitex Guerkeana*].

Hahl, German, about whom nothing is known but to whom Rechinger dedicated a number of species [*Faradaya Hahlii*].

Philippe Hahn (1859—ca.1915), French physician and botanical collector in Indochina from 1878 to 1896 [*Clerodendrum Hahnianum*].

Josiah Hale (?—1856), American physician in Louisiana, where he collected extensively before 1841 [*Verbena Halei*].

Francis Hamilton [né Buchanan] (1762—1829), noted English botanical author and collector in India and Nepal [*Clerodendrum Buchanani, C. Hamiltonii, Tectona Hamiltoniana, Volkameria Buchanani*].

Sir Arthur Charles Hamilton-Gordon, Baron Stanmore (1829—1912), English governor of Fiji, then of New Zealand, then of Ceylon; companion of John Horne on many collecting trips on the Fiji and Seychelles islands [*Clerodendrum Arthur-Gordoni*].

James Hannington (1847—1885), English missionary, bishop of East Equatorial Africa, where he collected plants; murdered in Uganda [*Bouchea Hanningtonii, Chascanum Hanningtonii*].

George Hansen (1863—1908), German horticulturist, early plant collector in California [*Verbena Hanseni*].

Charles Francis Harbison (1904—), contemporary American entomologist and natural history collector in southern California and northern Baja California [*Verbena Harbisonii*].

François Jules Harmand (1845—1921), French physician, ambassador, and botanical collector in Indochina [*Clerodendrum Harmandianum*].

W. von Harnier, German naturalist, collected along the White Nile in 1860 and 1861 [*Clerodendrum Harnierianum*].

William Henry Harvey (1811—1866), famous Irish phycologist, collected in Africa, Australasia, and the United States, assembled a huge herbarium [*Vitex Harveyana*].

Emil Hassler (1861—1937), distinguished Swiss plant collector, famous for his extensive collections in Paraguay, where he made the largest collections ever to be brought out of that country and where he died [*Aegiphila Hassleri, Casselia Hassleri, Hassleria, Lantana Hassleri, Lippia Hassleriana, L. polycephala* var. *Aemillii, Stachyterpheta Hassleri, Timotocia Hassleri, Verbena Hassleri, V. Hasslerana*].

George Tracy Hastings (1875—), beloved contemporary American botanical educator, author, and editor, collected in Chile and in various parts of the United States [*Aegiphila Hastingsiana*].

Warren Hastings (1732—1818), English governor-general of British East India [*Hastingsia*].

Oscar Lee Haught (1893—), contemporary American field geologist, collected in West Virginia, Texas, Peru, and Colombia [*Aegiphila Haughtii, Lantana Haughtii*].

Heinrich Carl Haussknecht (1838—1903), German botanist, collected in Europe, Syria, Mesopotamia, Kurdistan, and the Caucasus [*Vitex Hausknechtii*].

George Darby Haviland (1857—1901), English plant collector in Borneo, curator of the Sarawak Museum [*Callicarpa Havilandii, Geunsia Havilandii, Vitex Havilandii*].

August von Hayek (1871—1928), distinguished Austrian botanist, collected in Austria, Italy, and Egypt; author of many botanical works [*Junellia Hayekii, Verbena Hayekii*].

Johann Ernst Hebenstreit (1703—1757), German physician to King August I of Poland, professor of medicine at Leipzig [*Hebenstreitia*].

Lorentz Heister (1683—1758), German professor of botany at Helmstedt, author of numerous botanical works, sponsored many botanical dissertations by his students [*Burcardia Heisteri*].

Amos Arthur Heller (1867—1944), American naturalist, made extensive plant collections in various parts of the United States and in Puerto Rico [*Hellaranthus, Lippia Helleri, L. micromera* var. *Helleri*].

William Botting Hemsley (1843—1924), distinguished English plant taxonomist, known for his important work on the plants of Africa, China, and Central America [*Callicarpa rubella* var. *Hemsleyana, Vitex Hemsleyi*].

Augustine Henry (1857—1930), Irish plant collector, noted for his extensive and important collections in China [*Clerodendrum Henryi*].

Fortunato Luciano Herrera y Garmendia (1875—1945), distinguished Peruvian naturalist; professor of medicine, botany, and zoology at Cuzco; noted for his valuable collections of plants from the Peruvian Andes [*Aloysia Herrerae, Citharexylum Herrerae*].

Wilhelm Gustav Herter (1884—), contemporary German botanist, noted for his work on and collection of the flora of Uruguay [*Verbena Herteri*].

Theodor K. J. Herzog (1880—), contemporary German professor of botany at Jena, collected plants in Sardinia, Ceylon, Tunis, Corsica, Paraguay, Bolivia, Chile, and Argentina [*Aegiphila Herzogii*].

Benjamin Heyne (?—1819), Moravian missionary and botanical collector in India, where he died [*Callicarpa Heynei*].

Georg Hans Emmo Wolfgang Hieronymus (1846—1921), noted German botanical collector in Argentina [*Lampaya Hieronymi*].

Johann Maria Hildebrandt (1847—1881), famous German explorer and collector in Africa; combated fevers, scorbutic ulcers, and hostile natives; finally went to Madagascar, his health completely shattered, for further exploration, and there died [*Clerodendrum Hildebrandtii, Stachytarpheta Hildebrandtii, Vitex Hildebrandtii*].

George B. Hinton (?—1945), noted English plant collector in Mexico, where he made very valuable collections and discovered scores of new species and where he died [*Citharexylum Hintoni, Stachytarpheta Hintoni, Verbena Hintoni*].

Albert Spear Hitchcock [né Jennings] (1865—1935), beloved American agrostologist, collected extensively in many parts of the world, died at sea after returning from an expedition to eastern Africa where, at 70 years of age, he climbed Mt. Kilimandjaro in search of rare grasses [*Callicarpa Hitchcockii, Duranta Hitchcockii*].

Adrien Hock, Belgian plant collector in the Belgian Congo about whom little is known [*Clerodendrum Hockii, Vitex Hockii*].

Frederico Carlos Hoehne (1882—), contemporary Brazilian botanist of great distinction, expert on orchids, botanist on the Roosevelt-Rondon expedition in 1912-1913, indefatigable worker on the flora of Brazil [*Aegiphila Hoehnei, Lippia Hoehnei*].

Georg Franz Hoffmann (1760—1826), German physician, professor of medicine, and botanist; wrote extensively on lichens, fungi, willows, and umbellifers [*Hoffmannia*].

Johann Centurius von Hoffmannsegg (1766—1849), German taxonomist, famous for his work on the flora of Portugal [*Clerodendrum Hoffmannseggianum*].

Max H. Hollrung (1858—1937), German plant collector in New Guinea [*Vitex Hollrungii*].

Theodor Holmskjold [né Holm] (1732—1794), Danish nobleman, wrote on the plants of Denmark [*Holmskioldia*].

Carl Hugo Ehrenfried Wilhelm Holst (1865—1894), German plant collector in east Africa, where he died [*Clerodendrum Holstii, Premna Holstii*].

Maurice William Holtze (1840—1923), German botanist, successor of Schomburgk as director of the botanical garden at Adelaide [*Clerodendrum Holtzei*].

Henri Antoine Homblé (1883—1921), Belgian agronomist, collected plants and died in the Belgian Congo [*Vitex Homblei*].

Sir Joseph Dalton Hooker (1817—1911), famous English plant taxonomist, collected in India, Syria, Morocco, the Rocky Mountains, and Antarctic regions [*Callicarpa Hookeri, Geunsia Hookeri, Glandularia Hookeriana, Verbena Hookeriana*].

John Horne (1835—1905), Scottish plant collector in Mauritius and the Fiji islands [*Vitex Hornei*].

Thomas Horsfield (1773—1859), American botanist, collected extensively in India and Java [*Callicarpa Horsfieldii, Clerodendrum Horsfieldii*].

George Frederick Hose (1838—1922), English missionary who collected extensively in Malaya and the Straits Settlements [*Hosea, Hoseanthus*].

Nicolaus Thomas Host (1761—1834), Austrian naturalist, imperial physician at Vienna, author of many works on the flora of Austria [*Hosta, Hostana*].

Fr. W. R. Hostmann (1794—1864), German physician at Paramaribo where he became a wealthy man and spent much of his money collecting plants in Surinam and where he died [*Citharexylum Hostmannii*].

Carl Alexander Anselm von Hűgel (1794—1870), celebrated German explorer in Australia. [*Clerodendrum Hűgelii*].

Friedrich Heinrich Alexander von Humboldt (1769—1859), world-famous German nobleman, naturalist, and explorer, expert in all the sciences [*Aegiphila Humboldtii*].

John Hutchinson (1884—), contemporary English plant taxonomist, noted for his extensive work on African plants and on plant classification [*Premna Hutchinsonii*].

Thomas Henry Huxley (1825—1895), famous English naturalist and author, friend and champion of Darwin [*Huxleya*].

Arsene Isabelle (1795—1879), French naturalist, traveled and collected insects, mollusks, mammals, and plants in Argentina, Uruguay, and southern Brazil, later Uruguayan consul in France [*Verbena Isabellei*].

William Jack (1795—1822), Scottish plant collector in Bengal, India, and Malaya, died at sea in the Indian Ocean [*Clerodendrum Jackianum, Congea Jackiana, Sphenodesme Jackiana, Symphorema Jackianum*].

Thomas Johnson (?—1644), English apothecary and plant collector, editor of Gerarde's "Herball" [*Johnsonia*].

Sir Harry Hamilton Johnston (1858—1927), English artist and naturalist, collected in Uganda, Angola, Congo, Liberia, and Kenya [*Clerodendrum Johnstoni*].

Ivan Murray Johnston (1898—), contemporary American taxonomist, expert on the *Boraginaceae* and on the flora of temperate South America [*Verbena perennis* var. *Johnstoni*].

Pedro Jorgensen (1865—1937), distinguished Paraguayan plant collector, noted for his extensive plant collections in Paraguay and adjacent Argentina [*Citharexylum Jörgensenii, Lantana Jorgenseni, Lippia Jorgenseni*].

Sven Albert Brynolf Junell (1901—), contemporary Swedish morphologist, noted for his important work on the gynoecium morphology and taxonomy of the *Verbenaceae* and related families [*Junellia, Lantana Junelliana*].

Jurgensen, plant collector in Mexico from 1840 to 1845 about whom little is known [*Citharexylum Jurgenseni, Lippia Jurgenseni*].

Engelbert Kaempfer (1651—1716), German physician and botanist, collected in Persia, China, Japan, and the Sunda Islands [*Clerodendrum Kaempferi, Kaempfera, Volkameria Kaempferi, V. Kaempferiana*].

Wilhelm Kalbreyer (1847—1912), German plant collector in Africa and Colombia [*Clerodendrum Kalbreyeri*].

Masayasu Kanda, contemporary Japanese botanist and author [*Verbena Kondai*].

Gustav Karl Wilhelm Hermann Karsten (1817—1908), distinguished German botanist and author, collected plants in Colombia and Venezuela [*Citharexylum Karsteni*].

Conrad Keller (1848—1930), Swiss zoologist, traveler, and writer on eastern Africa [*Cyclocheilon somalense* var. *Kelleri*].

William Ashbrook Kellerman (1850—1908), American naturalist, an indefatigable collector in Guatemala, where he made very extensive and important collections and where he died; in spite of serious illness, he refused to quit his botanizing and exploration; "I think it was utter exhaustion and lack of sleep as much as malaria that caused his death. He would get up some mornings at 3 o'clock and start work" [156] [*Lippia Kellermani*].

José Steinbach Kemmerich (1876—1930), German naturalist, collected plants and animals in Algeria, northern Argentina, and especially Bolivia, where he died; his Bolivian plant collections are of the utmost importance [*Aegiphila Steinbachii*].

Edmund Kerber, collected plants in Mexico from 1879 to 1883, probably English [*Citharexylum Kerberi, Lantana Kerberi*].

Ellsworth Paine Killip (1890—), contemporary American taxonomist of the Smithsonian Institution, made extensive botanical collections in various parts of the United States, Cuba, Peru, and Colombia, expert on *Caesalpiniaceae, Mimosaceae, Passifloraceae,* and *Urticaceae* [*Aegiphila Killipii*].

Sir John Kirk (1832—1922), Welsh naturalist and explorer; on the Livingston expedition; his Upper Zambesi plants were sent to England in 1861 on the H. M. S. "Sidon" and were not heard of again until accidentally discovered in the Portsmouth dockyards in 1883 [*Clerodendrum Kirkii, Vitex Kirkii*].

Wilhelm Klemme (1869—), contemporary German forester, graduate of Cornell University forest school, collected in the Philippines from 1902 to 1918 [*Clerodendrum Klemmei*].

Guillermo Klug, (—1946), natural history collector in Peru, of German-Chilean parentage, noted for his fine collections of plants and butterflies [*Aegiphila sufflava* var. *Klugii, Petrea pubescens* var. *Klugii, Vitex Klugii*].

Clarence Emmeren Kobuski (1900—), contemporary American taxonomist and morphologist, specialist on the *Theaceae, Oleaseae,* and *Acanthaceae,* monographed the genus *Priva* [*Citharexylum Kobuskianum*].

Karl Heinrich Emil Koch (1809—1879), German botanist, expert on woody plants, professor at Jena, collected in the Caucasus, Armenia, and Asia Minor [*Callicarpa Kochiana*].

Franz Kohaut (?—1822), Bohemian horticulturist, collected in Crete, Egypt, Palestine, Martinique, and Senegal, where he died [*Petrea Kohautiana*].

Sijfert Hendrik Koorders (1863—1919), distinguished Dutch forester, collected extensively in the Netherlands East Indies [*Vitex Koordersii*].

Karl Alexander von Kraatz-Koschlau (1868—1900), German geologist and mineralogist who worked in Bosnia, Spain, Portugal, and especially Brazil, where he was head of the geology and mineralogy department of the Museo Paraense and where he died of yellow fever [*Vitex triflora* var. *Kraatzii*].

P. Krook, South African plant collector about whom little is known [*Bouchea Krookii, Chascanum Krookii*].

Arthur Krűcke, German plant collector in the Cameroons [*Vitex lokundjensis* var. *Kruckei*].

Boris Alexander Krukoff (1898—), contemporary Russian plant collector, noted for his important collections in Brazil, the Philippines, Sumatra, and Central America, expert on economic and poisonous plants, arrow-poisons, and drug plants [*Citharexylum Krukovii, Vitex Krukovii*].

João Geraldo Kuhlmann, contemporary Brazilian botanist of distinction [*Petrea Kuhlmannii*].

Hermann Kunstler, German plant collector in Singapore and Perak, died in Australia [*Premna Kunstleri, Vitex gamosepala* var. *Kunstleri*].

Carl Sigismund Kunth (1788—1850), famous German taxonomist and author to whom collectors from all over the world sent their specimens for determination [*Citharexylum Kunthianum*].

Henry Ewing Kuylen (1891—), contemporary British Honduran plant collector and forester who has done noteworthy plant collecting in Guatemala, Honduras, and Colombia [*Vitex Kuylenii*].

Jacques Julien Houtton de Labillardière (1755—1834), noted French collector in southern Europe, Syria, Lebanon, Cape of Good Hope, Australia, and Java [*Billardiera*].

Herman Johannes Lam (1892—), contemporary Dutch botanist of distinction, noted for his fine work on the *Verbenaceae* of the Malay

Archipelago [*Callicarpa Lamii, Lantana Lamiana, Premna Lamii, Vitex Lamiana*].

Jean Baptiste Antoine Pierre Monnet de Lamarck (1744—1829), world famous French naturalist and author of scientific subjects [*Avicennia Lamarckiana*].

Aylmer Bourke Lambert (1761—1842), distinguished English horticulturist, botanist, and author [*Glandularia Lambertii, Verbena Aubletia* var. *Lamberti, Verbena canadensis* var. *Lamberti, V. Lamberti*].

Christian Ludwig Landbeck (1807—1890), Alsatian ornithologist, collected plants and animals in Chile, where he died [*Verbena Landbecki*].

Jean Marie Antoine de Lanessan (1843—1919), French physician, professor of natural history, and author, governor-general of Indochina, collected plants in Indochina and Tunis [*Clerodendrum Lanessanii*].

Eugène Langlassé (?—1900), noted French botanical collector in Singapore, the Philippines, Indochina, Borneo, Mexico, and Colombia, died in Colombia [*Lantana Langlassei*].

Charles Herbert Lankester (1879—), contemporary English naturalist and coffee planter in Costa Rica who has collected butterflies, birds, and plants in Africa, Tenerife, Brazil, and Costa Rica, specializing in orchids [*Citharexylum Lankesteri*].

D. A. Larrañaga, Uruguayan naturalist about whom little is known; [*Lantana Larranagae*].

Marcel Désiré Joseph Laurent (1879—1924), Belgian horticulturist, director of the botanical garden at Eala [*Vitex Laurenti, V. Welwitschii* var. *Laurentii*].

Henri Lecocq (1802—1871), French naturalist, professor of natural history and director of the botanical garden of Clermont-Ferrand, author of a work on the phytogeography of Europe [*Verbena Lecocqi*].

Paul Henri Lecomte (1856—1934), distinguished French author on plant anatomy, economic botany, and taxonomy, director of the natural history museum at Paris, expert on the plants of Indochina, collected in Angola, Rhodesia, Madagascar, and South Africa [*Clerodendrum Lecomtei, Gmelina Lecomtei*].

Carl Ludwig Ledermann (1875—), contemporary Swiss horticulturist, collected plants in the Cameroons, Congo, New Guinea, and Pelew Islands [*Gmelina Ledermanni, Premna Ledermanni*].

Friedrich Carl Lehmann (1850—1903), German consul at Popayan, made important botanical collections in Jamaica, Central America, and Colombia [*Aegiphila Lehmannii, Lantana Lehmannii*].

Hermann Lehmbach, German plant collector in Cameroons in 1897 and 1898 [*Vitex Lehmbachii*].

Sir George Ruthven Le Hunt (1852—1925), Irish, government commissioner for a portion of the interior of Viti Levu, gave much assistance to Horne on the latter's collecting expeditions in Fiji, later governor of South Australia, then of Trinidad and Tobago [*Clerodendrum Lehuntii*].

Friedrich Wilhelm Ludwig Leichhardt (1813—1848), noted German explorer and collector in Australia, disappeared into the interior of that continent and was never found [*Gmelina Leichhardtii, Vitex Leichhardtii*].

Hugh Vandervaes Lely, English forestry officer and plant collector in Northern Nigeria [*Clerodendrum Lelyi*].

Emery Clarence Leonard (1892—) and his wife, Genevieve Mannakee Leonard [née Mannakee] (1902—), contemporary Americans, collected in northwestern Haiti in 1928 and 1929, the former a well-known expert on the *Acanthaceae* [*Lantana Leonardorum*].

Jean Baptiste Louis Théodore Leschenault de la Tour (1773—1826), famous French naturalist who collected plants in Australia, Timor, Java, India, Ceylon, Brazil, Guiana, and South Africa [*Trichorhiza Lechenaultii*].

Augustin Abel Hector Léveillé (1863—1918), voluminous French author on *Oenotheraceae, Rosa, Rubus,* and the plants of China [*Callicarpa Leveilleana*].

Lewellin, Australian plant collector about whom little is known [*Chloanthes Lewellini, Dicrastylis Lewellini*].

John Franklin Lewis (1903—), American naturalist and educator, specialist in lichens, ferns, and mosses, collected in Maine, New York, and Pennsylvania [*Aegiphila Lewisiana*].

Johann Lhotsky (1800—?), noted Austrian plant collector in Brazil, Tasmania, and New South Wales [*Aegiphila Lhotzkiana*].

Gustav Lindau (1866—1923), famous German taxonomist and lichenologist, author of numerous important works [*Clerodendrum Lindawianum*].

Hugo Lindemuth (1846—1908), German horticulturist [*Clerodendrum Lindemuthianum*].

Jean Jules Linden (1817—1898), famous Luxembourg botanist who collected very extensively in Cuba, Jamaica, Mexico, Guatemala, Colombia, and Brazil, discovering hundreds of new species of plants [*Citharexylum Lindenii, Clerodendrum Lindenianum, Vitex Lindeni*].

John Lindley (1799—1865), famous English horticulturist and botanical author [*Clerodendrum Lindleyi, Vitex Lindleyana*].

Carl Axel Magnus Lindman (1856—1928), Swedish plant collector in Brazil [*Lantana Lindmanni, Lippia Lindmanii, Verbena Lindmanii*].

K. Ling, Chinese plant collector about whom little is known [*Callicarpa Lingii*].

Carl von Linné (1741—1783), Swedish naturalist and author, son of the famous founder of modern binomial nomenclature [*Clerodendrum Linnaei, Glossocarya Linnaei*].

Auguste Lippi (1678—1704), Italian explorer and naturalist in Abyssinia, where he was murdered by natives [*Lippia*].

Francis Ernest Lloyd (1868—), contemporary English professor of botany at McGill University, noted for his work on insectivorous

plants, collected in Mexico, Alaska, Dominica, Java, Sumatra, Malaya, and at Puget Sound [*Clerodendrum Lloydianum*].

Thomas Lobb (1820—1894), noted English plant collector in India and Malaya [*Clerodendrum Lobbii, Hosea Lobbii, Hoseanthus Lobbii*].

Lobkowitz, presumably a German paleobotanic collector about whom nothing is known [*Vitex Lobkowitzii*].

David Lockhart (?—1846), English horticulturist, collected in the Congo, Trinidad, and Brazil [*Lantana Lockhartii*].

Gualterio Looser (1898—), contemporary Chilean botanist and collector, of Swiss parentage, author of numerous works on Chilean natural history [*Aloysia Looseri*].

Paul Gűnther Lorentz (1835—1881), German botanist noted for his collections in the Alps, in Argentina, and in Uruguay; professor of botany at Córdoba where he collected thousands of botanical and zoological specimens; after 5 years "dissatisfied with the state of things prevailing at the university, he began his lectures in 1874 with some short comments on the authorities, resulting in his dismissal from his post. Whilst planning another journey he was seized with smallpox; after his tedious recovery, being offered the professorship of natural science at Concepcion, in Uruguay, he thankfully accepted it. He spent six years in this town, describing it as a life-in-death sort of existence, varied by an occasional excursion for plants"; he died in Uruguay [*Duranta Lorentziana, Junella Lorentzii, Verbena Lorentzii*].

João de Loureiro (1710—1791), renowned Portuguese writer on the flora of Indochina [*Callicarpa Loureiri, Vitex Loureiri*].

August Friedrich Theodor Lucae (1800—1848), German botanist who assembled a magnificent herbarium of 40,000 specimens from 150 collectors [*Verbena Lucaeana*].

Edouard Piere Luja (1875—), contemporary Luxembourg naturalist, in charge of the expedition for collecting plants for the Paris Exposition of 1900, collected in Mozambique and the Belgian Congo, specialist in entomological collecting [*Clerodendrum Lujae*].

Peter Wilhelm Lund (1801—1880), Danish zoologist, paleontologist, and botanist, noted for his collections in Brazil [*Lantana Lundiana, Vitex Sellowiana* var. *Lundiana*].

Cyrus Longworth Lundell (1907—) and his wife, Amelia A. Lundell (1908—), Americans, made very extensive and important collections in British Honduras, Mexico, and Texas, the former author of numerous important papers on the flora of those regions [*Stachytarpheta guatemalensis* var. *Lundelliana, S. Lundellae, Verbena Lundelliorum*].

Bernhard Luschnath, Russian horticulturist, noted for his plant collections in Brazil from 1831 to 1837; he sent over 2000 living plants to Leningrad [*Aegiphila Luschnathi*].

Ly, Chinese plant collector about whom little is known [*Callicarpa Lyi*].

Calixto Mabesa (1892—), contemporary Filipino forester and wood technologist at the University of the Philippines, has done noteworthy work on the Philippine flora [*Clerodendrum Mabesae*].

Daniel Trembly MacDougal (1865—), famous contemporary American plant physiologist, collected plants in Arizona, Idaho, and elsewhere [*Verbena MacDougalii*].

Alexander Carroll Maingay (1836—1869), English surgeon, collected plants in China, Burma, Malacca, and Malaya, murdered in a mutiny at Rangoon; "many plants he obtained at Malacca have not been re-discovered and are perhaps extinct, owing to the extension of cultivation"[157] [*Callicarpa Maingayi*].

Edouard Ernest Maire (1848—), French missionary and botanical collector in China since 1872 [*Callicarpa Mairei*].

R. Maldonado B., contemporary plant collector in Argentina and Uruguay [*Lippia Maldonadoi*].

Gilbert Mandon (1799—1866), important French botanical collector in Bolivia and Madeira, brought out important specimens from the Andes [*Duranta Mandonii*].

Saverio Manetti (1723—1785), Italian botanist, director of the botanical garden at Florence, did much to bring about acceptance of Linné's system in Italy [*Clerodendrum Manetti*].

Gustav Mann (1836—1916), German plant collector in Africa and in India [*Clerodendrum Mannii*].

Hermann Wilhelm Rudolf Marloth (1855—1931), noted German plant collector in South Africa [*Volkameria Marlothii*].

Marques, Portuguese plant collector in Angola about whom little is known [*Vitex Marquesii*].

Leon François Martin (1866—1919), French missionary and botanical collector in China [*Premna Martini*].

Carl Friedrich Philipp von Martius (1794—1868), famous German botanist and explorer, author of the classic flora of Brazil [*Lippia Martiana, Petrea Martiana, Stachytarpheta Martiana, Vitex Martii*].

Charles Field Mason (1864—1922), brigadier-general in the United States army, chief health officer at the Panama Canal Zone [*Vitex Masoniana*].

Andrew Mathews (?—1841), English horticulturist, made important collections in Peru and Chile, author of an unpublished flora of Peru, where he died [*Aloysia scorodonioides* var. *Mathewsii, Lippia scorodonioides* var. *Mathewsii, Verbena Matthewsii*].

Benno Matthes (1825—1911), German plant collector in Texas and central United States [*Verbena Matthesii*].

D. M. Matthews, English conservator of forests in British North Borneo [*Faradaya Matthewsii*].

Eizi Matuda (1894—), contemporary Japanese plant collector in southern Japan, southern China, Formosa, Singapore, Java, and southern Mexico, noted for his exhaustive work on the flora of Chiapas [*Clerodendrum Matudae*].

William Ralph Maxon (1877—1948), noted American fern specialist, collected in Panama [*Stachytarpheta mutabilis* var. *Maxoni*].

Floyd Alonzo McClure (1897—), contemporary American plant collector and educator in China and Indochina [*Premna Maclurei*].

Edgar Alexander Mearns (1856—1916), American naturalist, member of the Roosevelt East African Expedition, a founder of the American Ornithologists' Union, an indefatigable collector of natural history specimens in various parts of the world, and author on botanical and zoological subjects [*Lantana Mearnsii*].

Mechow, collector in Angola in 1894 about whom nothing is known [*Vitex Mechowii*].

Charles James Meller (1836—1869), English naturalist on the Livingston Expedition in Africa, collected on Madagascar and the Zambesi, died in New South Wales [*Vitex Melleri*].

Elmer Drew Merrill (1876—), distinguished contemporary American plant taxonomist and administrator, famous for his work on the plants of the Philippines and eastern Asia [*Callicarpa Merrillii, Vitex Merrillii*].

Carl Heinrich Mertens (1796—1830), famous German world traveler, collected plants at Sitka, died of typhus on the return of an expedition to Iceland [*Citharexylum Mertensianum*].

Ernst Heinrich Friedrich Meyer (1791—1858), famous German botanical monographer, plant geographer, and historian, professor of botany and director of the botanical garden at Königsberg [*Priva Meyeri*].

Georg Friedrich Wilhelm Meyer (1782—1856), German botanist, professor at Göttingen, author of a flora of the Essequibo region in Guiana [*Avicennia Meyeri*].

Johannes August Theodor Meyer (1885—), contemporary German plant collector in Tanganyika, usually referred to and cited as "Hans Meyer" [*Clerodendrum Meyeri-Johannis*].

Teodoro Meyer (1910—), contemporary Argentinian botanist, specialist on the *Asclepiadaceae,* made the biggest collection of plants ever brought out of Chaco, also an important collector in Salta, Jujuy, Formosa, Tucumán, Río Negro, Chubut, and Santa Cruz [*Aloysia Meyeri*].

Pier' Antonio Micheli (1679—1737), famous Italian writer on the plants of Italy [*Michelia*].

Gottfried Wilhelm Johannes Mildbraed (1879—), contemporary German collector in the Cameroons and author of numerous works on plant taxonomy and nomenclature [*Clerodendrum Mildbraedii*].

G. R. Mills, English planter at Batu Gajah, Pahang, where he collected plants around 1925 [*Vitex Millsii*].

William Grant Milne (?—1866), English botanist who accompanied Capt. Denham's voyage on the H.M.S. Herald to Fiji, later explored the region around Old Calabar and the Cameroon Mountains in west Africa, died in Nigeria [*Premna Milnei, Vitex Milnei*].

Elisha Mitchell (1793—1857), American naturalist, educator, and author, renowned for his pioneer exploration in North Carolina, where he died by falling from a precipice on Black Mountain; it took 200 mountaineers 11 days to recover his body; "such were the characteristics, and principal events in the life of Dr. Mitchell, one of the pioneers in scientific research in these Southern States [that] at the news of his death, men of Science marked the loss of a learned associate, while members of

our National Cabinet and Ministers to foreign countries, Senators and Representatives in Congress, Governors of our States, with the Judges and their Legislators—Ambassadors from the Court of Heaven, and men of renown in all the liberal professions, distinguished Professors, with famous school-masters and hundreds of other pupils in the more retired walks of life rose up, in all parts of our country, to do honor to their revered preceptor'' [158] [*Priva Mitchelii*].

José Mariano Mociño [Suares Losada] (1757—1820), Mexican plant collector, noted for his work on the plants of Cuba and Mexico [*Citharexylum Mocinni*].

Charles Edward Moldenke (1860—1935) and his wife, Sophia Meta Moldenke [née Heins] (1876—), Americans, the former a distinguished Egyptologist, philologist, world traveler, and collector, botanized in Palestine, Europe, Egypt, Venezuela, the West Indies and various parts of the United States [*Timotocia*].

Harold Norman Moldenke (1909—), American, co-author of the present paper [*Citharexylum Moldenkeanum, Clerodendrum Moldenkeanum*].

Francisco Josué Pascosio Moreno (1852—1919), Argentinian anthropologist, collected plants in Patagonia [*Verbena Morenonis*].

Pierre Gilles Morière (1817—1888), French botanist, known for his work on the flora of Normandy [*Oxera Morieri*].

Johann Wilhelm Karl Moritz (1797—1866), famous German collector in the West Indies and Venezuela [*Lantana Moritziana, Lippia Moritzii*].

Thomas Morong (1827—1894), American collector in Argentina, Paraguay, Chile, and the Falkland Islands [*Lippia Morongii, Verbena Morongii*].

Marie Georges Mortechan (1883—), Belgian agronomist and collector in the Congo [*Premna Mortechani*].

Conrad Vernon Morton (1905—), contemporary American plant taxonomist specializing on the flowering plants and ferns of North America and the West Indies [*Aegiphila Mortoni*].

Műnzner, German collector in Tanganyika in 1909 [*Clerodendrum Muenzneri*].

José Celestino Mutis (1732—1808), famous early Spanish plant collector in Colombia, who sent his specimens to Linné, father and son, the bulk of his herbarium ignored for 150 years, only re-discovered and studied a few years ago [*Aegiphila Mutisii, Duranta Mutisii, D. repens* var. *Mutisii*].

George Valentine Nash (1864—1921), American plant collector in the West Indies and various parts of the United States [*Nashia*].

Andrés Naves (1839—1910), Spanish Augustinian friar who did considerable work on the plants of the Philippine Islands [*Clerodendrum Navesianum*].

Louis Née (17 —18), French botanist who explored parts of Argentina, Chile, Uruguay, Mexico, the coast of North America to Vancouver Island, and the Philippines, collecting about 10,000 specimens [*Verbena Neei*].

Ernest Nelmes (1895—), contemporary English librarian at the Royal Botanic Gardens, Kew, specialist on *Cyperaceae* [*Clerodendrum Nelmesianum*].

Edward William Nelson (1855—1934), American naturalist, noted for his botanical and zoological exploration of Alaska, the Arctic, and Mexico [*Bouchea Nelsonii, Stachytarpheta Nelsonii*].

Georg Balthasar von Neumayer (1826—1929), German author of a manual for travelers containing several botanical contributions, although not himself a botanist [*Clerodendrum Neumayeri*].

William Nicholas, assiduous English collector of plant fossils in Australia [*Dicrastylis Nicholasii*].

Toki Nishimura, Japanese botanist and plant collector of note [*Callicarpa Nishimurae*].

Konrad Ludwig Noack (1891—), contemporary German botanist and author [*Verbena Noacki*].

Noirot, Frenchman about whom nothing is known [*Clerodendrum Noiroti*].

Frank Oates (1840—1875), English ornithologist, collected plants and animals in South Africa, Central America, and California, died of African fever on an expedition in Southern Rhodesia [*Lippia Oatesii*].

Augustus Frederick Oldfield (1820—1887), noted English plant collector in Tasmania, New South Wales, and Western Australia [*Chloanthes Oldfieldii, Pityrodia Oldfieldii, Quoya Oldfieldii*].

Alcide Charles Victor Dessalines d'Orbigny (1802—1857), famous French scientist and explorer, traveled and collected in Argentina, Brazil, Chile, Bolivia, Peru, and Uruguay [*Aegiphila Orbignyana*].

Heman Chandler Orcutt (1825—1892), American naturalist, collected chiefly in Baja California, "always an active man, thinking of others, even those who had no claim upon him, he was esteemed in whatever community he resided. His love of nature and liberality secured to him many friends, and the work he did for the natural sciences and the encouragement he gave to the study still lives, and gives an impetus which quietly but surely will aid in its progress during uncounted years to come" [159] [*Verbena Orcuttiana*].

Gonzalo Fernandez de Oviedo y Valdés (1478—1557), early Spanish naturalist, collected plants in Italy, Hispaniola, and Colombia, governor of Cartagena and Santo Domingo, said to have been the first writer on American plants [*Ovieda*].

Edward Palmer (1831—1911), famous English plant collector in Florida, California, Arizona, and Mexico, brought out one of the most important collections of plants ever made in Mexico and the southwestern United States [*Bouchea Palmeri, Lippia Palmeri*].

Jean Armand Isidore Pancher (1814—1877), noted French botanist who collected in Tahiti, New Caledonia, and New Zealand, died in New Caledonia [*Oxera Pancheri*].

Alexis John Panshin (1901—), contemporary Russian forester, expert on wood anatomy and technology [*Vitex Panshiniana*].

Lorenzo Raimundo Parodi (1895––), contemporary Argentinian botanist of distinction and extensive collector [*Glandularia Parodii, Parodianthus, Verbena Parodii*].

Georg Paŭrle (1490—1555), German naturalist who wrote under the pseudonym "Joannes Agricola" [*Agricolaea*].

José Antonio Pavon (?—1844), famous Spanish botanist and explorer in Peru and Chile; plants accredited to him from Cuba, the West Indies, and Mexico were in reality collected by other Spanish botanists [*Aegiphila Pavoniana, Lantana Pavonii, Lippia Pavoniana*].

Richard William Pearce (?—1868), noted English plant collector for Veitch, botanized in Bolivia, Chile, and Peru, died of fever in Panama [*Duranta Pearcei*].

Henry Harold Welch Pearson (1870—1916), distinguished English botanist, famed for his work on South African plants; his untimely death was a severe blow to botanical science [*Clerodendrum Pearsoni, Vitex Pearsonii*].

Peekel, Dutch plant collector in the Bismark Archipelago from 1911 to 1925 [*Clerodendrum Peekelii, Premna Peekelii*].

Chien P'ei (1903—), contemporary Chinese plant taxonomist, noted for his monograph of the *Verbenaceae* of China [*Clerodendrum Peii*].

Sir Henry Pelham Fiennes Pelham-Clinton, Earl of Lincoln, 5th Duke of Newcastle-under-Lyme (1811—1864), sympathetic English patron of the natural sciences, influential in the revival of Kew under Hooker [*Newcastlia*].

Charles William Theodore Penland (1899—), contemporary American biologist, collected plants in Ecuador [*Duranta Penlandi*].

Francis Whittier Pennell (1886—), distinguished contemporary American plant taxonomist and specialist on the *Scrophulariaceae* and other groups, collected in Pennsylvania, Mexico, and Colombia [*Aegiphila Pennellii*].

Juan Tomás Perak (1916—1943), ill-starred Argentinian geneticist, who did noteworthy experimentation on the effect of colchicine on diploid species of cultivated plants, the duplication of chromosomes, obtained tetraploid maize, experimented on mutations induced by short-wave radiations, x-rays, and ultra-violet rays, died of radiation poisoning at the University of Missouri [*Glandularia Perakii, Verbena Perakii*].

Baron Pierre Eugène Perrier de la Bâthie (1825—1916), French botanist who worked on the plants of the Alps, Savoy, and Madagascar [*Vitex Perrieri*].

Perrin (17 —18), French botanical collector in the West Indies about 1808 concerning whom little is known [*Baeobotrys Perriniana*].

Lily Mae Perry (1895—), contemporary Canadian botanist now working at the Arnold Arboretum, author of a monograph of the North American species of *Verbena* [*Verbena Perriana, Vitex Perriana*].

Auguste Pervillé, French horticulturist at the Paris museum, collected in Madagascar and the Seychelles from about 1837 to 1840 [*Vitex Pervillei*].

Pételot (1885—), French botanist, professor of botany at the university of Hanoi since 1924, collected extensively in Indochina [*Callicarpa Petelotii*].

Wilhelm Carl Hartwig Peters (1815—1883), German plant collector in Mozambique [*Vitex Petersiana*].

Antoine Petit (?—1843), French zoologist, collected plants and animals in Abyssinia, devoured by a crocodile while crossing the Blue Nile [*Lantana Petitiana*].

François Pourfour du Petit (1664—1741), early French medicinal writer [*Petitia*].

Baron Robert James Petre (1713—1743), famous English horticulturist, built up a magnificent collection of exotic plants and was called "the Phoenix of this age" by Collinson; Linné spoke of his death as one of the greatest losses ever suffered by English botany or horticulture [160] [*Petrea*].

Rudolf Amandus Philippi (1808—1904), famous German botanist and collector in Chile, author of many valuable papers on the plants of that country [*Verbena Philippiana*].

Louis Picarda (1848—1901), French naturalist, professor of natural history at Port-au-Prince, made a fine collection of Haitian plants [*Clerodendrum Picardae*].

Dom Bento José Pickel (1890—), contemporary German botanist and forester, professor in the agricultural college at Tapera and taxonomist at São Paulo, has collected considerably in the Brazilian states of Pernambuco, Parahyba, and São Paulo [*Lippia Pickelii*].

Jean Baptiste Louis Pierre (1833—1905), French botanist, born on the island of Réunion, famous for his work on the flora of Cochinchina [*Clerodendrum Pierreanum, Premna tomentosa* var. *Pierriana, Sphenodesme Pierrei, Vitex Pierreana, V. Pierrei*].

Adolf Samoilovic Pitra (1830—1889), Russian professor of botany at the University of Kharkov, noted for his work in plant physiology [*Pitraea*].

Henri François Pittier de Fabrega (1857—), distinguished Swiss botanist famed for his extensive work on the flora of Costa Rica and Venezuela [*Clerodendrum Pittieri*].

Plato (427—348 B. C.), famous Greek philosopher [*Platonia*].

Charles Plumier (1646—1704), famous French naturalist, royal botanist to King Louis XIV, made three trips to the West Indies and published on the plants and animals of that region [*Citharexylum Plumieri, Duranta Plumieri*].

Eduard Friedrich Poeppig (1798—1868), famous German naturalist, professor and director of the zoological garden at Leipzig, collected in Cuba, Peru, Chile, Brazil, and the United States [*Citharexylum Poeppigii, Petitia Poeppigii, Poeppigia*].

Karl Pogge, German collector in Southwest Africa from 1882 to 1907 [*Clerodendrum Poggei, Vitex Poggei*].

Johann Emanuel Pohl (1782—1834), Czechoslovakian botanical collector of distinction, gathered material of 4000 species in Brazil [*Lantana Pohliana, Lippia Pohliana, Stachytarpheta Pohliana*].

Eugène Poilane (1887—), contemporary French plant collector who has collected over 32,000 numbers of plant specimens in French Indochina [*Callicarpa Poilanei*].

Thomas Powell (1817—1887), English missionary and naturalist, worked in the New Hebrides, Gilbert and Ellice Islands, Australia, and other parts of Oceania, noted for his valuable work on the plants and animals, mythology, and anthropology of Samoa; "wherever duty called to danger, he was ready and heroic, landing freely and unarmed on heathen shores, and moving about among the natives. On one occasion, and at the risk of his life, he grappled with a savage to rescue a young widow from being strangled on the death of her husband, but he was overpowered by the excited crowd, knocked to one side, and driven away from the horrid scene. This, however, was one of the deathblows to that cruel form of Sutteeism on Aneiteum";[170] he prepared a manuscript manual on the zoology of Samoa in the native dialect, but it was lost on a guano ship which left Samoa for England and was never heard of again [*Clerodendrum Powellii, Faradaya Powellii*].

Karel Boriwog Presl (1794—1852), Czechoslovakian taxonomist and botanical author of note, professor of botany at Prague [*Clerodendrum Preslii*].

Paul Rudolf Preuss (1861—), Polish plant collector in Sierra Leone, Ceylon, Java, New Guinea, and tropical America, founder of the botanical garden at Victoria, Cameroons [*Clerodendrum Preussii*].

Cyrus Guernsey Pringle (1838—1911), American botanist, famous for his wonderful collecting in the southwestern United States and Mexico, brought out one of the most extensive and valuable collections ever made in Mexico [*Callicarpa Priglei, Citharexylum Pringlei, Lippia Pringlei*].

Hesketh Prichard, English plant collector in Patagonia [*Verbena Pritchardi*].

Von Prittwitz, German plant collector in Tanganyika from 1874 to 1904 [*Clerodendrum Prittwitzii*].

August Adriaan Pulle (1878—), contemporary Dutch botanist of distinction, noted for his work on the flora of Surinam [*Geunsia Pullei*].

Joseph Anton Purpus (1860—1932), noted German plant collector in Mexico [*Cornutia grandifolia* var. *Purpusi*].

Léon Pynaert (1876—), contemporary Belgian botanist, director of the botanical garden at Eala and honorary director of the Jardin Colonial at Laeken [*Clerodendrum Pynaertii*].

Ellen Dorothy Quillan [née Schulz] (1892—), American plant collector in Texas [*Aloysia ligustrina* var. *Schulzii, Lippia ligustrina* var. *Schulzii*].

Jean Rémy Constant Quoy (1790—1869), French naturalist and zoologist, accompanied Freycinet on his voyage of exploration in 1819 and Captain Dumont d'Urville to the South Seas [*Quoya*].

Ludwig Adolph Timotheus Radlkofer (1829—1927), famous German authority on the *Sapindaceae* and prolific writer on botanical subjects [*Stachytarpheta Radlkoferiana*].

last 40 years of his life and devoted himself to scientific work [*Duranta Raimondii*].

Ramiz, Brazilian friend of Glaziou about whom nothing is known [*Citharexylum Ramizii*].

René Rapin (1621—1687), early French Jesuit writer on gardening [*Rapinia, Vitex Rapini*].

Samuel James Record (1881—1945), distinguished American forester and wood technologist, expert on the structure and identification of woods [*Recordia*].

John Reeves (1774—1856), noted English plant collector at Canton and Maçao [*Callicarpa Reevesii*].

Anders Fredrik Regnell (1807—1884), well-known Swedish explorer and naturalist, lived and collected in Brazil for 44 years, where he died [*Vitex Regnelliana*].

Alfred Rehder (1863—), famous contemporary German-American botanist, authority on the taxonomy and bibliography of woody plants, especially those of China [*Rehdera*].

Rehmann, German missionary and plant collector in Transvaal from 1875 to 1880 [*Clerodendrum Rehmanni, Lantana Rehmanni, Lippia Rehmanni, Vitex Rehmanni*].

Carl Friedrich Reiche (1860—1929), distinguished German plant collector in Mexico and Chile [*Aloysia Reichii*].

Eduard Martin Reineck (1869—1931), German plant collector in Brazil [*Lantana Reineckii, Verbena Reineckii, V. rigida* var. *Reineckii, V. venosa* var. *Reineckii*].

Ynes Enriquetta Julietta Reygadas [née Mexia] (1870—1938), distinguished American plant collector; her father was a Mexican general and diplomat; she made 5 collecting trips to Mexico, one to Alaska, and 2 to Brazil, Peru, Chile, and Ecuador, collected about 9300 numbers and 150,000 botanical specimens; became fatally ill in the mountains of Oaxaca [*Clerodendrum ternifolium* var. *Mexiae, Stachytarpheta Mexiae, Vitex Mexiae*].

Hendrik Adriaan van Rheede tot Drakestein (1637—1691), famous early Dutch botanical collector in Malabar, died at sea [*Callicarpa Rheedei, Gmelina Rheedii, Vitex Rheedii*].

Henry Nicholas Ridley (1855—), distinguished English plant taxonomist, explored and collected in Fernando de Noronha, Cocos, and Christmas Islands, Java, Borneo, Sumatra, and all parts of Malaya, famed for his work on the flora of the Malay Archipelago [*Callicarpa Ridleyi, Clerodendrum Ridleyi, Premna Ridleyi*].

J. G. Fr. Riedel (1832—1911), born in North Celebes, educated in Holland, a civil service officer in the Netherlands East Indies, lived and collected plants in Celebes, New Guinea, Timor, Amboina, and Borneo [*Clerodendrum Riedelii, Petraeovitex Riedelii*].

Ludwig Riedel (1790—1861), German plant collector in Brazil, where he botanized for 40 years and died [*Aegiphila Riedeliana, Lantana Riedeliana, Lippia Riedeliana, Riedelia*].

August Rimbach (1862—), German botanist, noted for his im-

portant collections in Ecuador and Uruguay [*Aegiphila Rimbachii, Citharexylum Rimbachii*].

A. Ringoet (1889—), contemporary Belgian agronomist, chief of the national agronomy service of the Belgian Congo [*Clerodendrum Ringoeti, Vitex Ringoeti*].

Robecchi, Italian collector in northern Africa [*Clerodendrum Robecchii*].

Benjamin Lincoln Robinson (1864—1935), well-loved American plant taxonomist, worked extensively on the flora of North America, Mexico, and the Galapagos Islands [*Stachytarpheta Robinsoniana*].

Charles Budd Robinson, Jr. (1871—1913), ill-starred Canadian plant collector, noted for his botanical exploration on the Philippine Islands and Dutch East Indies, murdered by natives on Amboina, his body cast into the sea and never recovered; tales of his having been devoured by cannibals are apparently untrue [*Clerodendrum Robinsonii, Sphenodesme Robinsonii*].

Frans Hubert Edouard Arthur Walter Robyns (1901—), distinguished contemporary Belgian botanist, director of the botanical garden at Brussels [*Vitex Robynsi*].

D. Rodriguez, noteworthy Argentinian plant collector noted for his work on the plants of Salta, Tueumán, and Misiones [*Lippia Rodriguezii*].

Leonard Rodway (1853—1936), English dental surgeon and botanist in Tasmania, where he died [*Lachnostachys Rodwayi*].

Karl Ferdinand Roemer (1818—1891), German professor of geology and paleontology at Breslau, collected in and wrote on the paleontology of Tennessee and Texas [*Verbena canescens* var. *Roemeriana, V. Roemeriana*].

Juan Tomás Roig y Mesa (1878—), contemporary Cuban botanist, specialist on woody and medicinal plants [*Callicarpa Roigii*].

George Thomas Rollisson (1843—1883), English horticulturist, died a suicide [*Clerodendrum Rollissoni, C. speciosum* var. *Rollissoni*].

William Roscoe (1753—1831), English horticulturist, founder of the Liverpool botanical garden [*Roscoea*].

John Nelson Rose (1862—1928), and his son, Joseph Sims Rose (1889—), American plant collectors in Mexico [*Citharexylum Rosei*].

A. von Rosthorn, German plant collector in China in 1891 [*Callicarpa Bodinieri* var. *Rosthornii, C. longifolia* var. *Rosthornii*].

William Roxburgh (1751—1815), famous Scottish botanist, collected plants at the Cape of Good Hope, St. Helena, and in India, author of a flora of India [*Callicarpa Roxburghiana, C. Roxburghii, Premna Roxburghiana, Vitex peduncularis* var. *Roxburghiana*].

Karl Rudolph (1881—1937), Czechoslovakian paleobotanist and plant geographer [*Premna mooiensis* var. *Rudolphi*].

Johann Moritz Rugendas (1799—?), German artist who accompanied Langsdorff in Brazil from 1821 to 1825, then resided in Italy and Sicily from 1827 to 1829, returned to South America and traveled there from 1831 to 1846 [*Citharexylum Rugendasii*].

Georg Everard Rumpf [or Rumphius] (1628—1702), famous German collector in the Dutch East Indies, lost all his collections by fire

and shipwreck, died on Amboina [*Avicennia marina* var. *Rumphiana, A. Rumphiana, Clerodendrum Rumphianum*].

Robert Runyon (1881—), contemporary American plant photographer at Brownsville, Texas, noted for his thorough collections of the flora of Cameron County [*Verbena Runyoni*].

Henry Hurd Rusby (1855—1940), distinguished American pharmacognocist, plant taxonomist, and explorer; he explored and botanized extensively in various parts of the United States, Mexico, Venezuela, Brazil, and Bolivia; a valiant fighter for pure food and drug laws; discovered and described over 400 new species of plants, mostly from Bolivia, to which country he made his last expedition at the age of 64; author of several books, including "Jungle Memories"; was several times reported as dead, was once placed, while in a coma from fever, in an open grave by his native guides, who sat about at the edge of the grave waiting for him to die, but recovered; an indefatigable and indomitable fighter for what he believed to be right, a key to his character is seen in these words of his written in a letter to a student "I can not say too strongly that in my opinion the first and most important consideration is absolute loyalty in adhering to principle. This does not mean stubbornness in having your own way when the decision is against you. It may be necessary to yield in practice, but you are not compelled to admit a wrong principle. Unfortunately honesty frequently does not yield results which are sufficiently immediate to warrant the old adage. Perhaps the dishonest people do win at the expense of the others, yet I would adhere to the honest course to the very end as the ultimate good of humanity depends on that sacrifice and the one object of life is the improvement of human character" [161] [*Bouchea Rusbyi, Clerodendrum Rusbyi, Lantana Rusbyi, Vitex Rusbyi*].

Paul George Russell (1889—), contemporary American botanist, collected plants in Mexico [*Verbena Russellii*].

Louis Martin Robert Rutten (1884—), contemporary Dutch geologist and paleontologist, collected plants in Cuba and the Netherlands East Indies [*Premna Ruttenii*].

Per Axel Rydberg (1860—1931), Swedish botanist, famous for his work on the Middle West and Rocky Mountains region of the United States; monographer of *Physalis, Rosaceae, Fabaceae, Carduaceae,* and other groups of the North American flora; a tireless worker in spite of physical handicaps and the spiteful animosity of some of his colleagues [*Verbena Rydbergii*].

Ramón de la Sagra (1798—1871), Spanish botanist, director of the botanical garden at Havana, noted for his work on Cuban plants [*Clerodendrum Sagraei*].

E. Sahelangi, native chief of a district of Minahassa, North Celebes, assisted S. H. Koorders during his botanical investigations of that region in 1894-1895 [*Clerodendrum Sahelangi*].

Auguste François César Prouvençal de Saint-Hilaire (1779—1853), famous French naturalist and explorer in Brazil and Uruguay, collected about 7600 numbers of plants [*Hilairanthus*].

Philipp Salzmann (1781—1851), noted German plant collector in Brazil from 1827 to 1830 [*Lippia Salzmanni*].

Theophilus Sampson (1831—1897), English plant collector who botanized in China for 31 years [*Vitex Sampsoni*].

Noel Yvri Sandwith (1901—), contemporary English plant taxonomist, specialist on the *Bignoniaceae,* ardent worker on the plants of the New World, collected in British Guiana [*Lippia Sandwithiana*].

Joseph Sylvestre Sauget, Brother León (1871—), French botanist of distinction, indefatigable worker on the flora of Cuba, expert on palms [*Callicarpa Leonis*].

Johann Conrad Schauer (1813—1848), famous German taxonomist, monographer of the *Verbenaceae* [*Avicennia Schaueriana, Lippia Schaueriana, Stachytarpheta Schaueri, Vitex Schaueriana*].

Georg Scheffler (?—1910), German plant collector in Africa, where he died [*Clerodendrum Scheffleri*].

Federico Schickendantz (1837—1896), German naturalist, collected extensively in Argentina, where he died [*Lippia Schickendantzii*].

Schiffer, German plant collector in Africa about whom little is known [*Clerodendrum Schifferi*].

Georg Heinrich Wilhelm Schimper (1804—1878), German naturalist, settled in Abyssinia in 1835 and botanized there until his death [*Lippia Schimperi, Premna Schimperi*].

H. J. F. Schimpff, German plant collector in Ecuador in 1934 [*Aegiphila Schimpffii*].

Diederich Franz Leonhard von Schlechtendal (1794—1866), German botanist of distinction, professor of botany and director of the botanical garden at Halle, author with Chamisso of many botanical papers [*Lippia Schlechtendalii*].

Frederich Richard Rudolf Schlechter (1872—1925), famous German collector in Africa, Sumatra, Java, Borneo, Malacca, New Guinea, and the Bismark Archipelago [*Bouchea Schlechteri, Chascanum Schlechteri, Clerodendrum Schlechteri, Gmelina Schlechteri, Vitex amboniensis* var. *Schlechteri, V. Schlechteri*].

H. J. Schlieben, German plant collector in Tanganyika in 1935 [*Clerodendrum Schliebenii, Premna Schliebenii*].

Louis Joseph Schlim, famous Luxembourg plant collector in Cuba, Jamaica, Colombia, and Venezuela [*Callicarpa Schlimii, Lippia Schlimii, Vitex Schlimii*].

Ernest Johannes Schmidt (1877—1933), famous Danish oceanographer, collected plants in Siam, co-author of a text on bacteriology, explored the Mediterranean, Atlantic, Caribbean, Gulf of Panama, China Sea, and Indian Ocean, as well as New Zealand, the Sunda Islands, Moluccas, and Cape of Good Hope; investigated the species and races of fish, their migrations, times and places of breeding, and larval and post-larval development; famous for his discovery of the breeding-place of eels [*Clerodendrum Schmidtii*].

Benno Julio Christian Schnack (1910—), contemporary Argen-

tinian botanist, specialist in the genetics of cultivated plants and the taxonomy of the *Verbenaceae* [*Verbena Schnackii*].

Sir Moritz Richard Schomburk (1811—1890), brother of the next, famous German collector in Guiana (1840) and then Australia, where he became director of the botanical garden at Adelaide and where he died [*Petrea Schomburgkiana, Vitex Schomburgkiana*].

Sir Robert Herman Schomburgk (1804—1865), famous German naturalist and collector in the West Indies and British Guiana (1835—1844), Siam, and Malaya [*Lippia Schomburgkiana*].

Arthur Carl Victor Schott (1814—1875), German naturalist, traveled and collected in southern Europe, Hungary, Turkey, Arabia, southwestern United States, Mexico, and Colombia; "a man of many talents, a good linguist, an accomplished scholar and artist, and a thorough naturalist . . . . an indefatigable worker, careful and systematic in his methods, and untiring in his efforts to advance the cause of science" [162] [*Citharexylum Schottii*].

Heinrich Wilhelm Schott (1794—1865), Moravian botanist of distinction, collected plants in Austria and Brazil [*Stachytarpheta Schottiana*].

Arnold Schultze, German plant collector in Cameroons from 1906 to 1911 and in Colombia from 1926 to 1928 [*Clerodendrum Schultzei*].

Augusto Gustavo Schulz (1899—), contemporary Argentinian botanist and educator, noted for his extensive collecting in and publications on the flora of the Chaco region, carried on under great handicaps and difficulties [*Aloysia Schulziana*].

Otto Eugen Schulz (1874—1936), distinguished German taxonomist, authority on *Melilotus, Brassicaceae, Erythroxylaceae,* and other groups [*Citharexylum Schulzii*].

Georg August Schweinfurth (1836—1925), born in Latvia of German parents; noted botanist, zoologist, geologist, anthropologist, and geographer; famous for his work in eastern central Africa, Libya, Eritrea, Egypt, and Arabia; "Schweinfurth's journey, which lasted three years [to east central Africa] was one of the most fruitful ever carried out by a traveller in Africa" [163] [*Clerodendrum Schweinfurthii, Vitex Schweinfurthii*].

Benedetto Scortechini (1845—1886), Italian plant collector in Australia, Indochina, the Straits Settlements, and Malaya, died at Calcutta [*Petraeovitex Scortechini, Vitex gamosepala* var. *Scortechinii*].

J. Séguin, French plant collector in China [*Callicarpa Seguini*].

Franz Seiner, German plant collector in Southwest Africa [*Vitex Seineri*].

Friedrich Sellow (1789—1831), German botanical collector, botanized for 17 years in Uruguay and Brazil, where he died; his collections are among the most important ever brought out of those countries [*Aegiphila Sellowiana, Aloysia Sellowii, Camara Sellowiana, Lantana Sellowiana, Lippia Sellowii, Stachytarpheta Sellowiana, Verbena Selloi, Vitex Sellowiana*].

Félix Seret (1875—1910), Belgian agronomist in the colonial service, collected plants in the Belgian Congo [*Clerodendrum Sereti, Vitex Sereti*].

Martín Sessé y Lacasta (?—1809), famous Spanish plant collector in Vancouver, Nicaragua, Cuba, Puerto Rico, and especially Mexico [*Citharexylum Sessaei*].

John Adolph Shafer (1863—1918), noted American plant collector in the West Indies, Argentina, Paraguay, and parts of the United States; "Dr. Shafer's several Cuban botanical collections, taken all together, are the largest ever made and studied from that island, and in scientific importance are second only to those of Charles Wright . . . . they contain specimens of several hundred species new to science" [164] [*Callicarpa Shaferi, Pseudocarpidium Shaferi, Vitex Shaferi*].

William Sherard [né Sherwood] (1659—1728), English pupil of Tournefort, collected in England, France, Switzerland, and Turkey, founded the Chair of Botany at Oxford, wrote under the pseudonym "Simon Warton, Anglus" [*Sherardia*].

Myrle Eunice Sherod [née Grenzebach], contemporary American monographer of the genus *Bouchea* [*Citharexylum Grenzebachianum*].

Homi Shirasawa, Japanese botanist and writer on the woody plants of Japan [*Callicarpa Shirasawana*].

Forrest Shreve (1878—), distinguished American ecologist and plant collector in northern Mexico and southwestern United States [*Citharexylum Shrevei, Verbena Shrevei*].

Robert James Shuttleworth (1810—1874), English conchologist and critical botanist, collected in Ireland, Switzerland, and France, assembled one of the largest personal herbaria of his time [*Schuttelworthia, Shuttleworthia*].

Philipp Franz von Siebold (1796—1866), famous German botanist and collector in Japan and the East Indies [*Callicarpa Sieboldii*].

Antonio Luiz Patricio de Silva Manso (1788—1818), noted Brazilian physician and botanist [*Casselia Mansoi, Timotocia Mansoi*].

Don Thomas Xavier de Lima Wogueira Vasconcellos Telles de Silva, 14th Viscount de Villa Nova, 1st Marquis de Ponte de Lima (1727—1800), Portuguese finance minister [*Limia*].

Philippo Silvestri, celebrated Argentinian zoologist and collector [*Junellia Silvestrii, Verbena Silvestrii*].

Simond, French botanical collector in Indochina [*Callicarpa Simondii*].

Abu Ali Alhosian Ben Sina (980—1037), famous Persian physician and naturalist [*Avicennia*].

Carl Johan Frederik Skottsberg (1880—), contemporary Swedish botanist and explorer, collected in Europe, United States, Chile, Juan Fernandez Islands, Hawaii, Japan, Fiji, New Zealand, Easter Island, and other parts of Oceanica [*Duranta Skottsbergiana*].

Alexander Frank Skutch (1904—), contemporary American ornithologist and botanist, collected in Jamaica, Central America, and Ecuador [*Aegiphila Skutchii*].

John Kunkel Small (1869—1938), distinguished American botanist, expert and prolific writer on the flora of the southern United States [*Citharexylum fruticosum* var. *Smallii*].

Albert Charles Smith (1906—), contemporary American taxonomist, collected in Brazil, Colombia, Peru, and the Fiji Islands [*Aegiphila Smithii*].

John Donnell Smith (1829—1928), American naturalist, collected in and assembled a huge collection of the plants of Central America, the West Indies, and United States [*Citharexylum Donnell-Smithii*].

Emil Heinrich Snethlage, German plant collector in Brazil in 1925 [*Vitex Snethlagiana*].

Jakob Reinbold Spielmann (1722—1783), Alsatian professor of chemistry, botany, and materia medica at Strassbourg [*Spielmannia*].

Richard Spruce (1817—1893), famous English explorer and collector in South America, where he botanized for 15 years [*Aegiphila Spruceana, Amasonia Spruceana, Duranta Sprucei, Lantana Sprucei, Stachytarpheta Sprucei, Vitex Sprucei*].

Roy White Squires, American plant collector in Venezuela, friend of Rusby [*Clerodendrum Squiresii*].

Gerold Stahel (1887—), contemporary Dutch naturalist in Surinname [*Vitex Stahelii*].

Paul Carpenter Standley (1884—), distinguished contemporary American taxonomist, expert on the *Rubiaceae* and *Chenopodiaceae*, collected extensively and a prolific writer on the flora of Mexico and Central America [*Aegiphila Standleyi, Citharexylum Standleyi, Clerodendrum Standleyi*].

Alois Staudt (?—1897), German plant collector in Cameroons, where he died [*Vitex Staudtii*].

Alban Stewart (1875—), contemporary American collector in the Galapagos Islands [*Verbena Stewartii*].

Julian Alfred Steyermark (1909—), contemporary American taxonomist, has done splendid collecting in Central America and various parts of the United States [*Citharexylum Steyermarkii*].

Adolf Ferdinand Stolz (1871—1917), South African Moravian missionary, collected plants in Nyasaland and Tanganyika [*Clerodendrum myricoides* var. *Stolzei*].

Harvey Elmer Stork (1890—), contemporary American botanist, specialist in the cytology of fungi and in wood anatomy, collected in Costa Rica and Peru [*Cornutia grandifolia* var. *Storkii*].

Stricker, German bookseller in Berlin, friend of Hildebrandt [*Vitex Strickeri*].

Franz Ludwig Stuhlmann (1868—1928), German plant collector in eastern Africa [*Clerodendrum rotundifolium* var. *Stuhlmanni, C. Stuhlmanni*].

Wilhelm Nikolaus Suksdorf (1850—1932), distinguished German plant collector in Iowa, California, Montana, Oregon, and Washington [*Verbena Suksdorfi*].

Harvey Adam Surface (1867—1941), distinguished American zoologist and educator expert in economic entomology, plant pathology, and all phases of nature study [*Aegiphila Surfaceana*].

Henry Knute Svenson (1897—), born in Sweden of American parents, expert on the *Cyperaceae*, collected plants in Ecuador and the Galapagos Islands [*Citharexylum Svensonii, Lantana Svensonii, Stachytarpheta Svensonii, Svensonia*].

Jason Richard Swallen (1903—), contemporary American agrostologist, collected plants in Brazil [*Petrea Swalleni*].

Olof Peter Swartz (1760—1818), famous Swedish botanist, collected in Sweden, Finland, Gotland, North America, Cuba, and Jamaica, wrote prolifically on fungi, lichens, mosses, ferns, orchids, and the flora of the West Indies [*Aegiphila Swartziana*].

Charles Francis Massey Swynnerton (1877—1938), English naturalist, collected in Southern Rhodesia, famous for his research on the tsetse fly, died in an airplane accident in Tanganyika while on a tsetse fly survey [*Clerodendrum Swynnertonii, Vitex Swynnertonii*].

Percy Amaury Talbot (1877—), English plant collector in Southern Nigeria [*Clerodendrum capitatum* var. *Talbotii, C. Talbotii*].

Taquet, French plant collector in Korea in 1911 [*Callicarpa Taquetii*].

Ralph Tate (1840—1900), English, "the accomplished and unwearied Professor of Natural Sciences in the University of Adelaide" [165], died in Australia [*Tatea*].

A. J. Teague, English plant collector in Southern Rhodesia in 1915 [*Clerodendrum Teaguei*].

Edward Teas, (1870—), contemporary American nurseryman of Houston, Texas [*Verbena Teasii*].

Francis Paul Louis Alexander, Duke of Teck (1837—1900), born in Austria, president of the Royal Horticultural Society of England and an influential supporter of horticulture [*Chloanthes Teckiana, Pityrodia Teckiana*].

Johannes Elias Teijsmann (1809—1882), Dutch forester and plant collector in the East Indies, died in Java [*Teijsmanniodendron*].

Tén, Chinese botanist and collector in Yűnnan, China, in 1917 and 1918 [*Premna Tenii*].

Gűnther Tessmann, German ethnographer, collected in west tropical Africa and Peru [*Clerodendrum Tessmannii*].

Augustin Clément Téteau, Brother Clément Joseph (1878—), contemporary French priest noted for his excellent plant collecting in Cuba [*Vitex Clementis*].

Theophrastos Eresios (370—285 B.C.), famous Greek philosopher and naturalist [*Elaeagnum Theophrasti*].

Berthold Ernst Friedrich Thomas (1910—), contemporary German botanist, ecologist, and agricultural chemist, monographer of the African species of *Clerodendrum* [*Clerodendrum Thomasii*].

Miss Thomas, Australian plant collector about whom little is known [*Dicrastylis Thomasiae*].

René Léon Xavier Thomas (1893—), Belgian forester and agriculturist, collected and published on the forest flora of Belgian Congo [*Vitex Thomasi*].

Mrs. W. C. Thomson (1836—1858), wife of a Presbyterian missionary at Old Calabar, Nigeria, who died there at the age of 22; her husband asked that the plant, a favorite of hers, he named in her honor; it is now one of our most popular cultivated vines [*Clerodendrum Thomsonae*].

Franz Thonner (1863—), Austrian botanist who collected in and published on the plants of Europe and Africa [*Clerodendrum Thonneri, Vitex Thonneri*].

Clovis Thorel (1833—1911), French plant collector in Indochina [*Premna Thorelii, Sphenodesme Thorelii, Vitex Thorelii*].

George Henry Kendrick Thwaites (1812—1882), English botanist, director of the Peradeniya botanical garden, collected and died in Ceylon [*Premna Thwaitesii*].

Adolphe Tonduz (1862—1921), famous Swiss collector in Costa Rica and Guatemala, where he died [*Avicennia Tonduzii*].

Tonini, Argentine collector in Patagonia from 1882 to 1884 [*Verbena Toninii*].

Rubén Torres Rojas (1890—), contemporary Costa Rican naturalist and educator, rector of the national university, noted for his botanical and zoological collecting in Costa Rica [*Lippia Torresii*].

John Torrey (1796—1873), famous American botanist, educator, and author, well-known for his work with Asa Gray on the plants of the United States [*Torreya*].

Charles Haskins Townsend (1859—1944), American zoologist, director of the New York Aquarium, collected plants in Alaska and the Galapagos Islands [*Verbena Townsendii*].

Richard Thomas Tracy (182?—1873?), learned Irish professor of obstetrics at the University of Melbourne and botanical collector [*Clerodendrum Tracyanum, Premna Tracyana, Vitex Tracyana*].

Henry Trimen (1843—1896), English botanist famous for his work on the plants of Ceylon [*Stachytarpheta Trimeni*].

H. T. Tsai, well-known contemporary Chinese botanical collector of the Fan Memorial Institute of Biology, collected 12,000 numbers in Yŭnnan, China [*Clerodendrum Tsaii*].

Nicolaus von Turczaninow (1796—1864), famous Russian botanist, voluminous writer on Russian plants and general taxonomy [*Cyanostegia Turczaninowii, Vitex Turczaninowii, Viticipremna Turczaninowii*].

James Tweedie (1775—1862), distinguished Scottish collector in southern Brazil, Uruguay, and Argentina, where he died [*Verbena phlogiflora* var. *Tweediana, V. Tweediana*].

Ernst Heinrich Georg Ule (1854—1915), famous German collector in Amazonian Brazil and Peru, discoverer of many new species [*Citharexylum Ulei, Clerodendrum Ulei*].

Ignatz Urban (1848—1931), famous German taxonomist at Berlin, noted for his critical work on the plants of the West Indies [*Citharexylum Urbanii, Petitia Urbanii, Urbania*].

Sergiei Semenovich Uvarov (1786—1855), famous Russian minister of education, during whose tenure of office Kieff University was established and the custom of sending young scientists abroad was revived, founder of an educational journal [*Uwarowia*].

El Baylío Fr. Don Antonio Valdés y Bazan (1744—1816), distinguished Spanish minister of the navy, known for his development of the Spanish navy, holder of numerous high political offices and recipient of many honors, founder of the botanical garden at Carthagena, publisher of several technical works [*Valdia*].

Juvenal Valerio Rodríguez, contemporary Costa Rican educator, inspector of schools, and director of the national museum, noted for his fine collection of Costa Rican plants [*Aegiphila Valerii*].

Morice Frans Jules Pieter Maria Vanoverburgh (1885—), Belgian missionary and collector in the Philippines [*Clerodendrum Vanoverberghii*].

Luang Vanpruk, native Siamese collector in Siam in 1911 [*Clerodendrum Vanprukii*].

Vauthier, noted French plant collector in Brazil from 1831 to 1833 about whom little is known [*Lippia Vauthieri, Vitex Vauthieri*].

Santiago Venturi, contemporary Argentinian botanist who has collected thousands of specimens in every part of that vast land [*Verbena Venturii*].

Françis Marie Camille Vermoesen (1882—1922), Belgian naturalist, curator at the Brussels botanical garden, lecturer at Louvain, government mycologist in the Congo, collected in and wrote on the flora of the Indies and of Belgian Congo [*Vitex Vermoeseni*].

G. M. Versteeg, Dutch plant collector in New Guinea in 1907 [*Clerodendrum Versteegii*].

Julius Rudolph Theodor Vogel (1812—1841), German explorer of the ill-starred Niger Expedition, botanized in Guinea, Fernando Po, and Sierra Leone, died of fever and dysentery at Fernando Po while preparing for further explorations into the interior; "he had spoken daily of the expected wanderings amongst the mountains, and even a few minutes before his death he asked his friend if he had got every thing ready for their excursion."[166] So affected was the great Hooker at the untimely death of Vogel that he wrote "Amongst many other individuals, one of the naturalists of the expedition . . . . has succumbed to the destructive influence of the climate. If, however . . . . it be the province of eloquence to commemorate illustrious minds, whose labours, owing to an unfortunate concurrence of circumstances, have not been

productive of commensurate effects, and so, to compensate for the want of incident, a more skilful pen than mine is requisite. I must be contented to show what the world and what science have lost, by the simple relation of a few circumstances, and by extracts from the last official records of the deceased'' [167] [*Vitex simplicifolia* var. *Vogelii*, *V. Vogelii*].

Johann Christoph Volckamer (1644—1720), German botanist at Nürnberg [*Volkameria*].

Georg Ludwig August Volkens (1855—1917), well-known German collector in northern and tropical Africa [*Vitex Volkensii*].

Georg Anton Volkmann, early German botanist who wrote on Silesian plants, but concerning whom little is known [*Volkmannia*].

Pemberton Walcott, plant collector in Australia [*Lachnostachys Walcottii*, *Walcottia*].

Nathaniel Wallich [né Nathan Wolff] (1786—1854), Danish surgeon, collected at the Cape of Good Hope and various parts of Asia, famous for his work on the plants of India and Nepal [*Callicarpa Wallichiana*, *Caryopteris Wallichiana*, *Clerodendrum serratum* var. *Wallichianum*, *C. serratum* var. *Wallichii*, *C. Wallichianum*, *Sphenodesme Wallichiana*].

Carl Friedrich Wilhelm Wallroth (1792—1857), German botanist, author of many works on the plants of Germany [*Wallrothia*].

Johannes Engenius Bűlow Warming (1841—1924), famous Danish collector in Greenland and Brazil [*Vitex polygama* var. *Warmingii*].

Georges Waterlot (1877—1939), French printer whose indefatigable zeal for natural history carried him to Senegal, Dahomey, Madagascar, and Sudan, where he collected plants, animals, minerals, and anthropological material; in recognition of his zeal and achievements he was awarded an honorary doctorate in science and made a chevalier of the Legion of Honor [*Vitex Waterloti*].

Charles Martin Weber, American soldier employed as a botanical collector by Merrill in the Philippines from 1911 to 1916 on funds provided by Oakes Ames, killed by natives on Balabac Island [*Callicarpa Weberi*].

August Weberbauer (1871—), German collector, famous for his extremely valuable work on the plants of Africa and the Andes [*Citharexylum Weberbaueri*, *Lantana Weberbaueri*, *Lippia Weberbaueri*, *Stachytarpheta Weberbaueri*, *Verbena Weberbaueri*].

Joseph Wedd, Australian about whom nothing is known [*Dicrastylis Weddii*].

Carl August Friedrich Weinland (1864—1891), German naturalist, collected and died in New Guinea [*Clerodendrum Weinlandii*].

Frederic Wellens (1891—1924), Belgian Catholic missionary in the Belgian Congo, where he collected plant specimens and where he died [*Vitex Wellensi*].

Frederich Martin Josef Welwitsch (1806—1872), Austrian botanist, director of the botanical garden at Lisbon, famous for his collecting in

Angola [*Clerodendrum Welwitschii, Siphonanthus Welwitschii, Vitex Welwitschii*].

Chester A. Wenzel (1882—), American plant collector in the Philippine Islands [*Clerodendrum Wenzelii*].

A. S. White, English plant collector at Fundisweni, Natal, in 1867 [*Clerodendrum Whitei*].

Thomas Whitfield, English plant collector in Sierra Leone from 1843 to 1848 [*Clerodendrum Whitfieldii*].

Alexander Whyte (1834—1908), Scottish plant collector in Kenya, Uganda, and Liberia [*Lippia Whytei*].

Maximilian Alexander Philipp zu Wied-Neuwied (1782—1867), Prussian prince who explored and collected botanical and zoological specimens in Brazil [*Lantana Maximiliani, Stachytarpheta Maximiliani*].

Ernst Wilczek (1867—), Swiss collector in Europe and South America [*Junellia Wilczekii, Verbena Wilczekii*].

Emile Auguste Joseph de Wildeman (1866—), distinguished contemporary Belgian taxonomist who did much work on the plants of Belgian Congo [*Clerodendrum Wildemannianum*].

Robert Statham Williams (1859—1945), American bryologist, collected plants of all groups in Montana, Alaska, Panama, Bolivia, and the Philippines [*Clerodendrum Williamsii, Premna Williamsii*].

F. Wilms, prolific collector in the Transvaal in 1895 [*Bouchea Wilmsii, Chascanum Wilmsii, Clerodendrum Wilmsii, Lantana Wilmsii, Lippia Wilmsii, Vitex Wilmsii*].

William Wilson (1799-—1871), English bryologist of note [*Wilsonia*].

Wimberley, presumably an English collector in Burma about whom nothing is known [*Vitex Wimberleyi*].

Ojvind Winge (1886—), contemporary Danish mycologist and geneticist [*Verbena Wingei*].

Hubert J. P. Winkler (1875—), contemporary German professor of botany at Breslau, specialist in plant taxonomy and geography, collected in the Malay Archipelago, Borneo, and east Africa [*Sphenodesme Winkleri*].

Gustave Ludwig Wittrock (1895—), contemporary American botanist, expert on the plants used by the Amerinds and on economic botany in general [*Vitex quinata* var. *Wittrockiana, V. Wittrockiana*].

Devillo D. Wood (1886—), contemporary American forester, formerly in the Philippine service, later director of forestry at Sandakan. collected in the Philippines, British North Borneo, Canada, and the United States [*Callicarpa Woodii*].

Georg Nikoloewitsch Woronow (1874—1931), Russian botanist, collected plants in Colombia [*Duranta Woronowii*].

Leonard Wray (1852—1942), English radiologist, naturalist, and inventor, invented a telephone in 1876, collected plants and animals in Malaya and Perak [*Premna Wrayi*].

Charles Wright (1811—1885), famous American collector in Mississippi, Texas, New Mexico, Arizona, Mexico, Cuba, Cape of Good Hope, Australia, Hongkong, the Bonin Islands, Liukiu Islands, Nicaragua, and the Behring Sea area, discovered hundreds of plants new to science, his is the most important plant collection ever made in Cuba [*Aloysia Wrightii, Callicarpa Wrightii, Lippia Wrightii, Pseudocarpidium Wrightii, Tetraclea Wrightii, Verbena Wrightii, Vitex Wrightii*].

Lajos János Xantus de Vesey (1825—1894), Hungarian botanist who collected in California and Mexico [*Verbena Xanthi*].

Alexander Zahlbruckner (1860—1938), Hungarian lichenologist of great distinction [*Lantana Zahlbruckneri*].

Luis Alberto Zamidio y Diaz, Brother Tomas Alberto (1908—), contemporary Colombian cleric and educator who has done considerable collecting in Colombia [*Lantana Tomasii*].

Paul Antonio Zappa, early Italian botanist, director of the botanical garden at Pavia [*Zapania, Zappania*].

Johann Nepomuk Felix Julius, Graf Zech auf Neuhofen (1868—), German collector in and later governor of Togo [*Vitex Zechii*].

Georg August Zenker (1855—1922), German botanist who collected and died in Cameroons [*Clerodendrum Zenkeri, Premna Zenkeri, Vitex Zenkeri*].

Carl Ludwig Philipp Zeyher (1799—1858), German botanist, noted for his collecting at the Cape of Good Hope [*Stilbe Zeyheri, Vitex Zeyheri, Xeroplana Zeyheri*].

Heinrich Zollinger (1818—1859), Swiss collector in the Netherlands East Indies, died in Java [*Callicarpa Zollingeriana*].

Attilio Zuccagni (1754—1807), Italian botanist, director of the botanical garden at Florence [*Stachytarpheta Zuccagni*].

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[2] M. J. P. Flourens, The Jussieus and the natural method, translated by C. A. Alexander, in Ann. Report Smithsonian Instit. *1867:* 246—276. 1868. Dr. J. H. Barnhart writes us under date of May 7, 1946: "Bernard de Jussieu, in a catalogue of the garden under his care, arranged all in a natural system; this was in 1759. I once assumed that this catalogue was published, but never located a copy, and it seems to have remained in manuscript until its outline was given in Juss. Gen. Pl. 30 years later." The Jussieu family is to French botany much what the Candolle family is to the Swiss or the Darwin and Lister families to the English. Six members of the family were famous botanists and apparently most or all of them were associated with the idea of a natural system: Christophle de Jussieu (1685—1758), Antoine de Jussieu (1686—1758), Bernard de Jussieu (1699—1777), Joseph de Jussieu (1704—1779), Antoine Laurent de Jussieu (1748—1836), and Adrien de Jussieu (1797—1853).

[3] A recent (1944) count based on the treatments in Engler & Prantl's "Die natűrlichen Pflanzenfamilien," Engler & Diels' "Syllabus," Engler's "Das Pflanzenreich," and other monographic works reveals the fact that about 14,009 genera are accepted today as valid and that these are classified in 965 families, Cfr. H. N. Moldenke, A preliminary classification of the plant kingdom to families (1944) and Supplement I. 1944.

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[7] Generic names in Adanson's and Jussieu's lists are spelled as these authors spelled them and are accredited as these authors accredited them as a matter of historical interest. These spellings and authorities are not necessarily the correct ones. Adanson gave two spellings for ten of his genera, but the spelling here listed is the one which he seems to have favored.

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[148] Some of these altitudes are based on actual figures given by the collectors on the labels of their specimens. Collections from these high alpine regions are very few in number. Undoubtedly more intensive collecting there will greatly modify and even advance many of these figures. Some of the altitudes are taken from R. Espinosa, Oekologische Studien űber Kordillerenpflanzen, pp. 36—37. 1932.

[149] F. Thonner, Blűtenpflanzen Afrikas, pl. 134. 1908.

[150] O. Beccari, Malasia *2:* 35, 211, & 314, pl. 4. 1884; F. Heim, in Assoc. Franc. Avanc. Soc. Bordeaux *1:* 51. 1895; Curtis, Bot. Mag. *129:* pl. 7887. 1903; Gard. Chron., ser. 3, *33:* 291 (1903) & *35:* 237. 1904.

[151] G. W. J. Mildbraed, Wissenschftliche Ergebnisse der deutschen Zentral-Afrika Expeditionen 1910—1911, *2:* 54 & 80. 1922.

[152] R. Pulteney, Historical and biographical sketches of the progress of botany in England, preface. 1790.

[153] N. J. de Necker, Enumeratio stirpium palatinarum annis 1768, 1769 collectarum, in Historia et commentationes Academiae Electoralis Scientierum et Elegantiorum Literarum Theodoro-Palatinae, Mannheim, *2:* 446—496. 1770.

[154] Dr. J. H. Barnhart states that "Aubert du Petit-Thouars" was the family name, in spite of the fact that most bibliographies place the name under "P" or "T".

[155] Journ. Linn. Soc. Bot. 5: 14. 1861.

[156] Journal of Mycology, volume 14, page 50. 1908.

[157] H. N. Ridley, Fl. Malay Penins. 1: xvi. 1922.

[158] Journ. Elisha Mitchell Scient. Soc. 1: 18. 1884.

[159] West Am. Sci. 8: 35. 1888.

[160] Paxton's Magazine of Botany, volume 4, page 200. 1838.

[161] Science, new series, volume 93, page 54. 1941.

[162] C. S. Sargent, Silva, volume 10, page 18. 1896.

[163] Nature, volume 116, page 686. 1925.

[164] Trillia, volume 10, pages 5—6. 1919.

[165] Trans. Roy. Soc. South Austral. 6: 33. 1883.

[166] W. J. Hooker, Niger Flora, page 21. 1849.

[167] W. J. Hooker, Niger Flora, page 1. 1849.

[168] E. G. von Steudel, Nomencl. Bot., ed. 2, 1: 29. 1840.

[169] H. G. L. Reichenbach, Conspectus regni vegetabilis per gradus naturalis evoluti, vol. 1, page 117. 1828. Reichenbach includes in the "*Verbeneae*" also the genera *Buddleja, Lycopus, Asaphes, Morina, Raputia, Sciuris, Buchia, Wallenia, Nuxia, Chilianthus, Hilsenbergia, Mendozia, Mendoncia, Perama,* and *Mattuschkea.*

[170] G. Turner, Chronicle London Missionary Society for June, 1887.

ADDENDA

Page 51, for "Brenes" read "Alberto Mora Brenes."

Page 57, "Adolfo Ducke, distinguished contemporory Swiss botanist . . ." read "Adolfo Ducke, distinguished Triestian botanist . . .".

Page 60, under "Howard Scott Gentry," change to read as follows, —"Howard Scott Gentry (1903—) contemporary American botanist and naturalist, collected extensively in the southwestern United States and Mexico, and contributed much to the botany, paleontology, and anthropology of the Rio Mayo region of Mexico."

Page 61, For "Goossens" read "Antoine Petrus Gerhardy Goossens."

Page 62, before "Philip Hahn," insert "François Louis Hahn (1844—) or maybe."

Page 67, Under "Jão Geraldo Kuhlmann," add "(1881?—); born of German parents."

Page 68, Under "Eugène Langlassé," add that he collected also in "Malaya."

Page 71, under "R. Maldonado B.", indicate that the "B." stands for "Bustos."

Page 72, For "Mechow" read "Alexander von Mechow," and for "nothing" read "little."

Page 84, Under "Julian Alfred Steyermark," add that he collected also in "South America."

Page 89, under "F. Wilms," change "F." to "Frederick," and add that he collected in "South Africa from 1883 to 1897, chiefly in eastern Transvaal."

PLANT LIFE LIBRARY

DARLINGTON & AMMAL'S "CHROMOSOME ATLAS OF CULTIVATED PLANTS"

HAMILTON P. TRAUB

Plantsmen, particularly those interested in plant breeding, have felt the need for a ready reference work giving chromosome numbers of plants under cultivation and their near relatives. To search in the literature each time when the need arises is time consuming, and such a search is not even possible in the case of many who are located far from comprehensive plant science libraries. It is fortunate therefore that Darlington & Ammal have provided a valuable book on this subject.[1]

Dr. Darlington has gone a step farther, and has contributed a concise, thought provoking introduction, covering the "Origin of Cultivated Plants"; the importance of chromosomes in plant systematics, and the use and meaning of chromosome numbers.

The main portion of the book, giving in detail the information about the chromosomes of Gymnosperms and Angiosperms, covers 309 pages. The subject is arranged by genera under plant families, and fortunately these authors have chosen Hutchinson's "Families of Flowering Plants" (1926, 1934), with a few exceptions, as the basis of their arrangement. For each genus the basic (x number) of chromosomes is given, followed by the 2x, or diploid number of chromosomes for each species listed under it, followed by citations to the literature, classification by means of symbols of the plant from the standpoint of economics, and finally the habitat. To stimulate work on important economic plants for which no chromosome information is available, the authors have entered these, necessarily leaving blanks to be filled in when the information is later reported.

This important work was prepared during the war years, and the authors are to be congratulated for the extensive coverage of the subject under the circumstances. It is to be expected that under the conditions, some of the recent work was not available for inclusion. As an instance, the subject of the *Amaryllidaceae* can be cited. The important work in this field by Dr. Flory and others, and the two comprehensive summaries by Flory and Yarnell; and by Flory (Herbertia 1937 and 1944) were apparently not considered, but this deficiency will undoubtedly be made good in a future edition, for the authors state that they wish to "hear from our colleagues in all parts of the world of errors, omissions and possible additions, for correction and use in a later edition."

---

1 C. D. Darlington and E. K. Janaki Ammal. **Chromosome Atlas of Cultivated Plants.** London. George Allen & Unwin. The Macmillan Co., 60 Fifth Ave., New York. pp. 297. 1945. $2.75.

Some of the omissions noted among important tropical and subtropical crops are: the cover crop, the Sarawak Bean, *Dolichos hosei; Crotolaria spectabilis* and other *Crotolaria* species extensively grown in the Southeastern United States, to mention only a few, are not included.

The following errors in nomenclature for *Amaryllidaceae* should be noted: *Habranthus robustus* is listed as "*Zephyranthes robusta*"; *Habranthus Andersoni* var. *texanus* is listed as "*Zephyranthes texana*"; *Zephyranthes grandiflora* is listed as "*Z. carinata (grandiflora)*"; *Crinum bulbispermum* is listed as "*C. capense (longifolium)*"; *Brunsvigia rosea* (Lamarck) Hannibal is given as "*Amaryllis belladonna*"; *Amaryllis vittata* and *Amaryllis hybridum* are listed as "*Hippeastrum vittatum*" and "*Hippeastrum hybridum*"; *Amaryllis blumenavia* is listed as "*Griffinia blumenavia.*"

Omissions for the *Amaryllidaceae* where chromosome counts are available include *Ixiolirion tataricum, Tulbaghia violacea,* and many others.

As indicated above, Hutchinson's classification (1926, 1934) is followed, but the *Allieae* and *Agapantheae* are retained in the *Liliaceae.* This is very unfortunate from the standpoint of the student of the *Amaryllidaceae.* Although the chromosome data are important to the systematist, the morphological characters have very great weight, and when both are considered the *Allieae* and *Agapantheae* decidedly belong with the *Amaryllidaceae.* It is hoped that the authors will reconsider this matter after taking into account the chromosome summaries of Flory and Yarnell; and Flory (Herbertia 1937, 1944).

It should also be noted that the genus *Hosta* with a chromosome complement similar to that of *Agave, Yucca,* etc., has been retained in the Tribe *Hemerocallideae. Hosta* undoubtedly belongs with the *Agaveae* for its species represent typical *Agaveae* that have evolved under a mesophytic environment. With the removal of the genus *Hosta* from the Tribe Hemerocallideae, this tribe undoubtedly belongs with the *Amaryllidaceae* for *Hemerocallis* has the typical amaryllid chromosome complement (x = 11), and the gross morphology of the group is similar to that of the amaryllids.

The listing of the omissions and corrections in this review should not in any way be interpreted as detracting from our endorsement of this important book. It is indispensable to all who are seriously interested in plants. Science is constantly developing and for that reason our texts must be revised at intervals to register that progress, but in the meantime, this first edition will serve its very useful purpose.

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FOREWORD

PLANT LIFE for 1947, a general edition, is devoted to gladiolus and the Netherlands Bulb Industry. We are indebted to W. M. James for a stimulating article on the winter- and spring-flowering *Gladiolus* species, a subject of major interest to gladiolus breeders. The illustrations are especially noteworthy. The readers will be much interested in the two historical articles on the Dutch Bulb Industry contributed by our good friends, Dr. A. J. Verhage and J. F. Ch. Dix. These articles will fill in the knowledge gap left by the Nazi blackout from 1940 to 1945.

Hamilton P. Traub
Harold N. Moldenke

TABLE OF CONTENTS

Foreword 3

Notes on Winter- and Spring-flowering *Gladiolus* species, W. M. James 5

The Dutch Bulb Industry, 1940 to 1945, and its Prospects, Dr. A. J. Verhage 23

Development of Bulb-Culture in the Netherlands, J. F. Ch. Dix 27

Plant Life Library—
Brimble's "Flowers and Trees in Britain," Hamilton P. Traub 41

Jaeger's "A Source-Book of Biological Names and Terms, Hamilton P. Traub 42

ILLUSTRATIONS

PLATES

Plate 1. *Gladiolus cardinalis elegans* 7

Plate 2. *Gladiolus alatus* 8

Plate 3. *Gladiolus gracilis* 13

Plate 4. *Gladiolus recurvus* 14

Plate 5. *Gladiolus tristis* as grown in California 16

Plate 6. *Gladiolus tristis* X *Senorita* 19

Plate 7. *Gladiolus alatus* X *Sarabaud* 20

TEXT FIGURES

Figure 1. *Gladiolus callistus* 10
Figure 2. *Gladiolus tristis* 12
Figure 3. *Gladiolus tristis,* cross-section of leaf 15

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem,* if any, *leaves, scape* and *flowers.* Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

NOTES ON WINTER- AND SPRING-FLOWERING GLADIOLUS SPECIES

W. M. James, *California*

A review of the origin and history of the present *Gladiolus* hybrids; a survey of the findings in the genetics and cytology of the genus, combined with the description of some of the lesser known species furnishes the foundation for an inquiry into possible future developments. Although the genus is best known by the modern hybrids, their culture and management will not be discussed to any extent because it has been so well described and is easily available in a variety of publications.

There are many definitions of the term species (5), no one of which is entirely satisfactory. Linnaeus, in developing the present system of plant nomenclature considered the species as a static unit. Early taxonomy was developed solely with this conception and only on a morphological basis. With the development of genetics and cytology there was a definite tendency to include physiological and geographical characteristics in determining plant classification. Today when defining a species, many taxonomists emphasize genetical more than they do morphological characteristics.

A detailed description of the mechanics of heredity may be found in any book on genetics. The chromosome count has proven very helpful in the study of *Gladiolus* species and has been especially useful in hybridizing.

In 1935 Dr. Ronald Bamford (3a and 3b) published the chromosome number of thirty-five species, eight species hybrids, twenty-one winter flowering hybrids and sixty summer flowering commercial varieties. This confirmed the few previous reports and showed the genus to have a heteroploid nature with a basic chromosome number of fifteen. He shows that: the South African species are diploid with thirty chromosomes; the tropical and East African are diploid with thirty chromosomes, tetraploid with sixty chromosomes or hexaploid with ninety; and that the Eur-Asian species are polyploid with from ninety to one hundred eighty chromosomes. The winter flowering commercial varieties are diploids, triploids or tetraploids and the summer flowering kinds examined were all tetraploids.

There are some two hundred species in the genus (1). A few occur in Asia Minor, the Mediterranean region and tropical Africa, with the majority in South Africa. The Eur-Asian forms were known to the Greeks and Romans. Cultivation of three of these, namely *G. segetum* Linn., *G. communis* Linn., and *G. byzantinus* Linn., was started in Europe during the Middle Ages. These three and forms selected from them were the only gladiolus grown in gardens until the beginning of the Eighteenth Century. About that time some of the South African species were sent back from the Cape Peninsula by the

early English and Dutch settlers. The scented ones were cultivated as much for that quality as for the beauty of their flowers.

However, they did not receive much attention for improvement of the genus by hybridization did not start until the beginning of the Nineteenth Century. Although some of the records may be questionable, apparently twenty-four species have been used to date in the development of our present horticultural forms (6). It is interesting to note that these are all natives of Africa.

The first hybrids on record were raised by Dean Wm. Herbert, who started working with them about 1807 and continued until his death in 1847. His work was scientific rather than horticultural and none of his hybrids have continued to the present time nor were they used in developing the modern varieties.

Gladiolus Colvillei was the first commercial hybrid and was introduced by the originator, Mr. Colville of Chelsea, England, in 1823. Although there is some uncertainty and a little controversy, the parents were probably *G. tristis* var. *concolor* and *G. cardinalis* (Plate 1). Both of these species are diploids with thirty chromosomes. The cross proved somewhat variable, one sport being described in 1860. In 1872 *G. Colvillei* var. *albus,* with colored anthers, appeared simultaneously in two Dutch nurseries. Later a variety of this appeared with white anthers.

Gladolius ramosus was probably the next hybrid of any importance. The date of introduction is unknown and there is considerable uncertainty as to its origin. However, it is known to have been in cultivation in England in 1835. There is a possibility that it was a hybrid between *G. cardinalis* and *G. oppositiflorus,* although there is considerable evidence that *G. oppositiflorus* was not known until later and possibly *G. blandus* was the other parent. This cross was a distinct advance and was used for hybridizing and cultivated extensively for many years but these hybrids are not being grown to any extent at the present time.

In 1839 a seedling obtained from Colville's Nursery bloomed and was named *G. insignis.* Its parentage is unknown. These three hybrids are classed as early-flowering because they bloom only in the spring. The first two are diploids with thirty chromosomes and the third one is probably the same.

All three of these and their hybrids were extensively cultivated by the middle of the Nineteenth Century. Although their popularity declined after that, they are still grown to some extent commercially. They do not have any connection with the present horticultural forms of summer flowering gladolius.

In 1837 a new line of development of the gladiolus was begun. It proved to be the foundation for the modern commercial forms. There is some doubt as to the parentage and origin of the first individual in this group. In 1841 Louis van Houtte introduced *G. gandavensis* and it is generally believed that it was the product of a cross between *G. psittacinus* and *G. oppositiflorus.* This original hybrid has been reported as still being grown as late as 1916 at Verrieres, in Paris.

Gladiolus cardinalis elegans

Plate 1

Gladiolus alatus

Plate 2

In turn other hybrids were introduced in Europe and America as *G. Lemoinei, G. nancianus, G. Childsii, G. Kelwayi,* Groff's Hybrids and *G. Kunderdi.* These races did not maintain their distinct characteristics because intercrossing was done to such an extent that individual identity was lost and they are all referred to now as the large-flowered hybrids.

In 1902 another distinct development in the modern commercial forms was made by the re-introduction of *G. primulinus.* This Rhodesian species was crossed with the large-flowered forms. These crosses produced considerable diversity because of the great variation in the hybrids, and new forms are still being developed because of the *G. primulinus* addition.

The parents of the modern hybrids were diploid *(G. oppositiflorus* with thirty chromosomes) and hexaploid *(G. psittacinus* with ninety chromosomes) and the result of their union was a tetraploid with sixty chromosomes. And *G. primulinus* is also a tetraploid, which probably explains the ease with which new hybrids were obtained by its use.

It is interesting to note that the parents of the so-called early-flowering forms are from the Cape District in South Africa and are winter or spring blooming. The parents of the present popular commercial varieties are from the eastern part of South Africa and from Tropical Africa. They bloom in summer or fall. And it is also interesting that so few of the known species have been used to produce the remarkable advance and variety shown in our modern hybrids. The variation in color, form, size, and fragrance of the other South African species makes them extremely interesting to work with. Even the foliage of some species varies greatly from the familiar "sword" shape of the garden hybrids.

The fragrance varies in kind and intensity. Because of the differences between people in the sense of smell (4), it is convenient to classify these kinds of fragrance as sweet, such as we find in liliums, hyacinths, freesias, etc., or spicy, such as that found in pinks and carnations.

In the 1930's the writer grew several of these lesser known South African species to flowering size and was able to do a little hybridizing with them. The brief descriptions which follow are by the writer and are from observations made from those plants grown in Santa Barbara.

G. alatus Linn. (Plate 2) is a jaunty little plant known as Kalkoentje (Little Rooster) in the Cape District. The flowers are not very big, but appear large in comparison to the rest of the plant. The stems are six to twelve inches tall with from four to six flowers. The flowers are an orange red, sometimes called flame, and have a very different shape than do those of the commercial forms. There are three broad upper segments and three narrow lower segments. The middle upper segment is at first fully hooded, later reflexing at its apex. These appear bright with their "flame" color. The three longer, ribbon-like lower segments turn downwards and are greenish yellow, except for their "flame" colored tips. *G. alatus* extends from virtually the Cape

itself to the dry lands immediately south of the Orange River. The color varies considerably in different localities from the bright "flame" of the type to a so-called pink which is actually more of an old rose. The flower has a delightful fragrance resembling that of apple blossoms if a little imagination is used. It is variable in strength in individual plants and not perceptible to many people. It blooms in late spring and is very attractive in table arrangements.

G. brevifolius Jacquin is rather common in the southwest of the Cape Province. Flowers are small, vary in color from pink to lilac and are very sweetly scented. One of the few kinds which bloom in early fall with the foliage appearing later on.

Fig. 1. *Gladiolus callistus*

G. callistus F. Bolus (Fig. 1) has a decidedly distinct form of flower. The flower stem is two to four feet long, occasionally with one or two branches and with nine to twelve flowers which vary in color from white to light lavender. The general appearance of the flower is cup-shaped, about two and one-half inches in diameter growing partially erect on the stem. The upper segment is slightly wider and longer than the lateral segments. The three lower segments are about the

same size and shape as the upper lateral ones. It blooms in spring and is well worth growing. The "sweet" fragrance of the flowers is not strong enough to be an asset.

G. carmineus C. H. Wright, is another one flowering in the fall with foliage appearing later. The blooms are large in comparison with the rest of the plant and are a bright, intense pink in color. There are generally five to six blossoms on an eighteen inch stem.

G. crassifolius Baker is a summer blooming species found mostly on the eastern side of South Africa where there are summer rains and more or less winter drought. Interesting principally because of its habit of growth. The five or six leaves are very crowded, rigid, and one and one-half to two feet long. The flower stem is the same length with many rather small, more or less campanulate, reddish flowers which vary in color considerably.

G. gracilis Jacquin (Plate 3) is a sweet scented dainty species blooming in the winter. The two or three leaves are grass-like, twelve inches long and not prominent. The three to six flowers are borne on a stem sixteen to twenty-four inches long. They are somewhat narrowly trumpet shaped and vary in color from a yellowish form with little blue to a bluish form with little yellow. Found in Cape Colony.

G. grandis Thunberg is an early summer flowering species rather common in the Cape Peninsula. The few leaves are twelve to eighteen inches long, slender and grass-like in appearance. The attractive flowers are comparatively large, broadly funnel shaped, and brownish in appearance. They are borne three to four on a slender stem eighteen to thirty inches long and have a strong, spicy fragrance at night.

Night fragrance is not exactly correct as this scent is soon noticeable if the flowers are cut any time of day and placed in a darkened room. Dr. McLean (8) reports that Dr. Bogert has determined that this odor is produced by an unstable cinnamic aldehyde, or a closely related compound. This aldehyde is easily decomposed by light containing ultra-violet rays.

G. hirsutus Ker-Gawler has several varieties. It is found in the southwestern part of the Cape Colonies. Not particularly attractive in itself, but the plant seems vigorous. The twelve to twenty inch flower stem is hairy throughout its length. The color varies somewhat, but is mostly a bright pink a little on the cerise side. It has a very strong, pleasant sweet fragrance.

G. odoratus L. Bolus blooms in early autumn before the foliage develops. The flowers have a brownish appearance at a little distance. Actually there are many small reddish purple dots on a dull yellow background. There are four to fourteen flowers on a twelve to sixteen inch stem. The spicy fragrance is continuous night and day and is the strongest encountered by the writer.

G. recurvus Linn. (Plate 4) is fairly common throughout the Cape Peninsula and varies in color from a yellowish white to a clear pale blue. It has a delightful, strong sweet fragrance. Stems are twelve

to twenty-four inches long with from two to six flowers. The bluer forms are very attractive. Blooms in early spring.

G. splendens Baker is a native of Cape Province and is found in the mountains at about 1600 feet altitude. The corm is very small, almost non-existent, with many wiry roots and it seldom makes cormlets or offsets. The leaves are many in a dense tuft and are about twenty four inches long. The flowers are large, broadly trumpet shaped and have a bright scarlet-red color. It blooms in late summer and is exceptionally attractive.

Fig. 2. *Gladiolus tristis* as a cut flower.

G. tristis Linn. (Plate 5, and Figs. 2 & 3) and *G. tristis* var. *concolor* (Baker) have been grown in Santa Barbara, California, and vicinity for many years and also have been grown in Great Britain since the middle of the eighteenth century. It sometimes becomes almost naturalized in a garden which is not cultivated too intensively. The flowers are creamy white with varying amounts of brownish or

Gladiolus gracilis

Plate 3

Gladiolus recurvus

Plate 4

purplish markings. The variety *concolor* has no markings. Both have four to eight flowers on two to three foot stems. The leaves are grass-like in appearance and have a cross section resembling a Moline Cross (Fig. 3). The strong, spicy night fragrance is very agreeable. It is almost uncanny the way the fragrance will gradually permeate several rooms in a dwelling when a bunch of flowers are brought in towards evening. *G. tristis*, and the variety *concolor* are rather common in the southern part of the Cape Province. There is a yellow form in the mountains forther east.

Fig. 3. *Gladiolus tristis*, cross-section of leaf; original was ¼ to ⅜ inch in diameter.

G. viperatus Ker-Gawler is probably a synonym of *G. orchidiflorus* Andr. It is found on the west side of South Africa from the Cape to Namaqualand. Known locally as the green Kalkoentje. It is shaped like *G. alatus*, but is taller. Has greenish blooms marked brown and a strong sweet fragrance.

Plate 5 **Gladiolus tristis** as grown in California

G. Watermayeri L. Bolus is another of the smaller gladiolus with a flower shaped like that of *G. alatus*. Blooms in early spring with a strong sweet fragrance. The color is cream or light yellow with crimson veining.

G. watsonius Thun. (2) seems to have been a headache for the taxonomists, as it has also been known under five other names: *G. revolutus, G. recurvus, G. praecox, Antholyza revoluta* and *Homoglossum Muttoni*. The writer has not determined the preferred name, so will use the term *G. watsonius* because the seed was received under that name. The center of the three upper segments is definitely hooded. The two lateral upper segments and the central lower segment are about the same size and are arranged with about equal angles between them. The two lateral lower segments are smaller than the upper center one and extend sideways. The flower has a triangular appearance. This shape and a bright orange-scarlet self color make the flower very attractive. It is found in Cape Colony.

These fourteen species are less than half, and the most interesting and unusual, of those flowered and observed by the writer. All of them were found to be diploids with thirty chromosomes by Dr. Bamford (3a and 3b). He has pretty well established the chromosome counts for the genus *Gladiolus*. If the entire genus was re-examined on the basis of a broader conception of what constitutes a species, there might be some changes. The taxonomists are uncertain about *G. watsonius* on a morphological basis inasmuch as it has been known under several names. *G. alatus* has several color variations which are found in separate localities with one carrying a varietal name. *G. Watermeyeri* is similar to *G. alatus* in many respects and they have the same chromosome number. Isn't it possible that *G. alatus* and its color forms and *G. Watermeyeri* are only geographical variations of the same species? *G. tristis* has a variety *concolor* and a yellow form. And there are others which may be only geographical forms instead of separate species or named varieties as at present.

The brief description of these winter and spring flowering species was intended to point out several characteristics it would be desirable to incorporate in the summer flowering horticultural forms. This will not be easy. In the first place some of those with the most desirable characteristics proved to be very difficult to grow in Santa Barbara. The wrong pH may have been partly responsible. Most of these species are from lime free districts and both the water and soil have a high lime content in Santa Barbara. All are intolerant of poor drainage, although some *(G. cardinalis* and *G. primulinus)* grow under the edge of waterfalls and *G. tristis* grows along stream banks. All seem to be very susceptible to *Bacterium marginatum*. This was controlled very well by soaking in a solution of bichloride of mercury (1 ounce to 5 gallons of water). In using this disinfectant it is well to remember that protein and many kinds of dirt will precipitate or inactivate it and more salts must be added to the solution, after it has been used, to bring it up to proper strength or a fresh solution used for each group

of corms treated. The organic mercury compounds, such as Semesan, are just as effective when properly applied. However, the organic forms are held in suspension rather than in solution and are not very practical unless all husks are removed from the corms and the mixture kept agitated during the treatment. Four hours is probably sufficient. Up to twelve hours in the solution did no harm. [*Mercury compounds are poisonous and due caution should be exercised in handling them.*]

They will cross with the summer flowering tetraploids, but the result is a triploid and for practical purposes is sterile (Plates 6 and 7). Dr. Bamford has been able to make certain crosses with the triploids, but it generally took many attempts and then he had considerable difficulty germinating the seeds resulting from these crosses.

The reported origin of the summer flowering horticultural forms was a hexaploid-diploid cross between *G. psittacinus* and *G. cardinalis* or *G. oppositiflorus.* It is probable that this could be repeated with other diploids, but there are several difficulties involved. Getting the flowers in bloom at the same time is very difficult with some of the species. *G. psittacinus* blooms only in the fall and most of the diploid species mentioned bloom in late winter and spring. Several storage methods tried would not keep the pollen alive long enough to be of any use. By holding the corms in cold storage and then growing them under glass where temperature, light and moisture could be kept under control, it should not be too difficult to get them in bloom at or near the same time.

Sporadic attempts to add the fragrance of some of the species to the garden forms have proved discouraging. *G. tristis* crosses with them readily, but the resulting hybrids are sterile from a practical viewpoint and are always scentless.

Some one hundred years ago Dean Herbert crossed *G. tristis* and *G. recurvus.* The resulting hybrids had a slightly modified *tristis* form and only the *recurvus* fragrance. He called this cross *fragrans.* It was propagated for some time, but eventually disappeared.

Starting in 1925, Dr. Forman T. McLean made this same cross (9, 10). Extensive work with hybrids F-1, F-2 and a backcross F-1 X *tristis* gave some clues to the problems involved and a definite indication of the genetic principles of the inheritance of fragrance in these two species. Studies of some 2200 individuals indicated that the *recurvus* fragrance was dominant and dependent on two factors, either or both of which may be heterozygous and that the *tristis* fragrance is recessive and also dependent on two factors, one of which must be homozygous while the other may be heterozygous providing the *recurvus* fragrance is not present.

All species crosses made with *tristis* by the writer were without the *tristis* night fragrance in the first generation. An F-2 generation of *tristis* X *callistus* had one plant with light lavender flowers shaped like those of *tristis* and with the strong night fragrance of *tristis. G. tristis* X *G. watsonius* had very little *tristis* fragrance even in the F-2 generation. However this second generation did produce a few plants with

Gladiolus tristis X *Senorita* (triploid)

Plate 6

Gladiolus alatus X *Sarabaud* (Triploid); flowers about 2 inches across; color similar to that of *Sarabaud*.

Plate 7

flowers the shape and size of *tristis* that were a bright orange-scarlet self color. Even though there was no fragrance, the flowers were decidedly attractive. *G. hirsutus* carried its fragrance strongly in the F-1 generation, although little was accomplished with this cross because weather conditions at blooming time made pollinating and seed growing almost impossible. Neither *G. alatus* nor *G. Watermeyeri* showed any of their fragrance in the F-1 generation of several crosses. *G. viperatus* with a strong day fragrance gave similar results.

Although the winter and spring flowering species cross readily, it is better to grow them under glass for hybridizing. The species just discussed were all grown out of doors in the open ground and many a cross could not be made because of foggy or rainy weather. And many a seed pod which was growing nicely when first examined would be a soggy mass a few days later because of damp weather. And all attempts to mature the seed by cutting the stem after the ovary had started development and putting it in water under cover were failures.

The best approach to developing fragrance in the garden forms would probably be to produce a hybrid with a dominant fragrance from the fragrant diploid species and then change it to a tetraploid by crossing with a hexaploid. Enough work along this line has already been done and recorded to indicate some of the difficulties which would be encountered and the methods most likely to succeed.

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THE DUTCH BULB INDUSTRY, 1940 TO 1945, AND ITS PROSPECTS

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When in 1939 the war between England and Germany broke out, the Dutch Bulb Industry still was in a difficult position. The years of crisis after 1929 had considerably weakened the position of the Industry but in the years prior to the war it was on the road to recovery. This is evident, indeed, from the fact that in 1930 the acreage in the Netherlands planted to bulbs had increased to about 23,000 acres, and the export value amounted to about f. 46,400,000. Soon there was an overproduction, and in 1933 a culture restriction was introduced which reduced the acreage to about 17,000 acres. This crisis clearly was due to the fact that in 1932 the export value of bulbs from the Netherlands had decreased to f. 19,200,000. After that the export as well as the export value constantly increased. In 1938, the last normal year before the war, upwards of 52,000 tons of bulbs were exported, valued at about f. 31,300,000.

Table 1. Export of Dutch bulbs from the Netherlands, 1938

Countries	Weight in Kilograms (Kgr.)	Value in Dutch Guilders
United States of America, Canada, New Foundland, Cuba, Mexico and Central America	8.225.645	5.076.687
United Kingdom, Eire, Gibraltar, etc.	28.278.862	16.725.502
Germany, Austria, Hungary, Czechoslovakia	4.325.826	2.674.313
France, Belgium and Luxemburg, Switzerland, Italy, Spain, Portugal, Roumania, Bulgaria, Greece, Turkey, Yugo-Slavia, French Morocco and Tangier, Algeria, Tunisia	4.186.549	2.461.391
Soviet-Russia, Poland with Dantzic, Esthonia, Lettonia, Lithuania and Memel	352.037	220.981
Sweden, Norway, Denmark, Iceland, Finland	5.882.520	3.615.743
Asia, Africa, South America, Australia	917.032	550.507
Total	52.168.471	31.326.124

Examining the export figures (summary in table 1) it appears that Great Britain has been the principal purchaser of the Dutch bulbs which

need not surprise us as this flower-loving people highly appreciate the beauty of this Dutch product. Great Britain bought in 1938 about 28,000 tons with an export value of about f. 16,500,000. Other important purchasers were the United States of America who bought about 6,500 tons with a value exceeding f. 4,000,000; Canada with 1,500 tons with a value of about f. 1,000,000; Sweden and the other Scandinavian countries who together purchased approximately 5,900 tons with a value of f. 3,600,000; France, Belgium and Luxemburg, Switzerland and other countries speaking Romance Languages, and the Balkan States who jointly received nearly 4,200 tons with a value near to f. 2,500,000; Germany purchased approximately 3,900 tons in 1938 with a value upwards of f. 2,400,000.

When in 1939 the war between Great Britain and Germany broke out, the shipping season was well under way. Great Britain at once stopped the import of Dutch bulbs. This was considered unavoidable in connection with an effective war effort. In response to the export difficulties the Dutch Government in the autumn of 1939 decided to decrease the acreage planted to hyacinths and tulips.

When on the 10th of May, 1940, our country was taken over so treacherously, the bulb Industry had been reduced to a size of about half or 2/3 of that in pre-war years. During the war and the German occupation, the situation remained unchanged although the Netherlands authorities in this period of occupation took far-reaching measures to raise the production of food-stuffs to as high a level as possible. That even during this period the acreage planted with bulbs decrease only slightly (7% decrease for daffodils) has been attributed to the fact that bulbs are grown principally in parts of Holland in a special kind of soil that is little suited for the production of food-stuffs. Moreover, the continuation of bulb culture offered the advantage that a number of laborers could be thus employed and so were withdrawn from the German war-machine. This was premeditated. It should be pointed out that this offered the most important opportunity for laborers to "dive" in order to thus withdraw themselves and escape the hard fate of being sent out to be put to work in Germany. This often entailed serious difficulties to the bulb growers individually, but thanks to their organized activity, the resistance could not be broken during the entire duration of the Nazi occupation.

Circumstances during the war were most difficult for the bulb industry. A serious shortage of artificial manure as well as of stable manure prevailed and other materials also were practically unobtainable. Nevertheless, the bulb industry was able to continue although under great difficulties. In the realms of combating diseases and the raising of new varieties, most noteworthy results were obtained in the years of Nazi occupation. When the war was over, it may safely be said that the bulb industry through a compulsory export of its products to Germany (which did not assist in any way the war action) and hard work, despite the dangers of war, came out of the ordeal with a higher quality product.

In the autumn of 1944, when it became obvious that the end of the war was drawing near, it was decided (in concert with the reliable Dutch authorities) to extend the area planted to bulbs—increasing tulips by 30%, and hyacinths and daffodils each by 15%. At that time in our country, shut out from the rest of the World, we were of the opinion that after the war large sales opportunities would present themselves. So, when finally the liberation become a fact, a most optimistic spirit prevailed in the bulb Industry. The disabled state of things in the country made communication with foreign countries difficult and it was not until August before cables from America could be replied to. Bulbs used to be sold abroad by traveling salesmen from the beginning of January to the end of April, and it is comprehensible that the abnormal sales-season, together with the difficulties of communication just before the shipping season, affected disadvantageously the quantities exported. Yet, in 1945, the exporters succeeded in shipping about 4,000 tons of bulbs to America. The most important market, Great Britain, alas, was far below normal. After discussions had been carried on between the British and the Netherlands Ministers of Agriculture concerning the export of bulbs to Great Britain, the British Government granted an import quota for bulbs which led to an export upwards of 4,000 tons to that country.

The prospects for the bulb industry are in great measure connected with the trades' policy which in the near future will be applied in our markets. It has already become evident that our products still are much appreciated in all the countries to which we could ship our bulbs after the war. The policy of fixed quotas which to an important extent is a result of the poverty in Europe, however, sets limits which even the best and most appreciated product cannot overcome. If this policy of fixing quotas which in general is impeding the international nursery trade in Europe will be maintained, the sale of our product will meet with considerable restrictions. Opposite to the European trades' policy is that of America, and that of the countries of the Southern Hemisphere, that also are important for the sale of Dutch bulbs. These countries do not operate on a quota basis.

In the campaign for reopening the markets, the firm intention of the Netherlands Government not to allow any more exports which could lead to a disturbance of the price-level on the markets of the purchasing countries, is playing an important part. The economic life of the Netherlands will be regulated in accordance with a fixed policy and the Bulb industry too will live up to this policy. The measures already taken before the war are being maintained. Then inland minimum-prices were fixed, below which the growers were not allowed to sell. By adding a minimum-margin for exporters-profit, foreign minimum-prices are arrived at. As far as we know, no speculation has occurred under that system, but measures have now been perfected, and it is no longer possible to offer bulbs abroad below the minimum-export prices, to be fixed by the industry as a whole under the approval of the Government.

A number of new measures have been taken to ensure the application of the system, such as the centralized collection of the claims against the foreign customers, and the fixing of minimum export prices also for miscellaneous bulbs. It is evident that these measures will protect the foreign customers against price speculation on their markets and the measures for output restriction will prevent overstocking the foreign markets. It clearly appears from the above that it is the firm will of the Dutch Bulb Industry to follow a new course in its export policy, and that, viewed from the trade angle, few objections can be raised against an import of this commodity that satisfies many needs on the markets. That such needs prevail, we certainly need not make clear to British readers. As early as the first year of our liberation, it became evident that the English public still highly appreciates our products.

During the war, many rumors were spread about the damage caused to the Netherlands bulb farms. It is quite evident now that these rumors were exaggerated, but still it is of interest to consider what damage the Nazi measures for their defence have caused to the bulb cultures. That such damage has occurred is obvious if one realizes that these cultures were situated in or near the periphery of the areas that the Nazis had chosen on which to build their Atlantic "Wall." As a matter of fact, about 700 farms have suffered damage from this construction. The cases of serious damage are fewer than was first reported, but yet many working-plants and buildings were demolished, and many areas have become unusable owing to tank-traps, barbed-wire entanglements, "asparagus" anti-tank, bunkers and similar obstacles. The affected growers for the most part succeeded in removing their bulb cultures to grounds situated somewhat more inland. Although the damage is considerable, it did not affect greatly the production. Abroad it has often been feared that inundations would cause damage to the bulb cultures. The areas utilized, which in general were situated on a relatively higher level, escaped widespread inundations in the western part of Holland, but water was raised constantly higher and higher, and consequently it was feared that our cultures might ultimately be flooded. If the liberation had come a month later, this no doubt would certainly have happened. But the liberation came just in time, not only to prevent mortality from hunger, but also to save the bulb cultures from inundation.

When writing about the awful hunger during the winter of 1944-1945, we may add that in that period tulip bulbs were a much appreciated human food. The surpluses that were taken out of the market at minimum prices were being sold at prices fixed by the Government. Many people owe their life to these tulip bulbs. It should be noted also that even in war time the surpluses were not worthless. During the whole occupation period tulip and crocus bulbs have proved to be a most valuable element for coffee substitutes, and daffodils and hyacinths,

the first after certain pretreatments, constituted a most appreciated forage for our live stock. The following analyses (Table 2) may enable our readers to judge the nutritive value of these bulb products that played such an important role when the scourge of war was upon us.

Table 2. Nutritive values of Dutch bulbs, daffodils, tulips, hyacinths, etc.

Kind of bulb	Proteins	Fatty substances	Carbohydrates	Crude fiber	Ash	Moisture
	%	%	%	%	%	%
Daffodils	2.5	0.3	29.6	1.8	1.3	64.5
Tulips	3.8	0.2	34.2	1.6	1.0	59.2
Hyacinths	2.4	0.1	24.3	1.0	1.0	71.2
Gladiolus	3.0	0.2	25.4	1.4	1.3	68.7
Crocus	5.2	0.3	42.2	2.5	1.1	48.9
Dutch Iris, mixed *White Excelsior* and *Imperator*	3.9	0.3	28.4	1.8	1.8	63.8
Dutch Iris, *Wedgewood*	2.6	0.5	30.2	1.3	1.8	63.6
Anemones, mixed	8.2	0.5	65.0	6.1	4.7	15.5

The enemy has now been repulsed again, and although the occupation period has left us with a difficult road ahead, yet we are energetically engaged in the work of restoration. We realize that mistakes that have been made in the past will have to be avoided in the future. For that reason a conscious export policy is being pursued and all measures are being taken to furnish the very best quality bulbs only, and to guarantee their arrival in first class condition. We are counting on the good will of our allied friends to give us the chance to rebuild our country so hard hit during the war.

DEVELOPMENT OF BULB-CULTURE IN THE NETHERLANDS

J. F. Ch. Dix

DEVELOPMENT OF BULB-CULTURE

The great is born out of the small and so it was with Dutch bulb-culture. When in 1554 Busbequis, the Emperor Ferdinand's ambassador, saw for the first time tulips in flower between Adrianople and Constantinople, he could not have imagined that from these tulips and some other bulbous plants, some centuries later a grand culture and a very important trade of international significance would develop in Holland. Four centuries passed away, but during the first three centuries the bulbs played their part principally in amateur circles. Even in the famous "Tulip Speculation," in the 17th Century, the trade did not make any progress; on the contrary, after that period the trade in tulips declined for a time.

The hyacinths too became known in the 16th Century; the daffodil probably was native to Holland, but these plants also reached their international significance later. Other bulbs and tuberous plants had also assumed commercial importance later. Those, who are acquainted with

modern bulb-culture and know how much knowledge of soils, fertilizers, etc., is required, are not surprised at this. So, in 1850, three centuries after the import of the first tulip bulbs, the planted area did not exceed 300 H. A. (about 750 acres).

However, this rather small area is easily to be explained. At that time the growers applied themselves to the raising of varieties, the more the better, but only in very small quantities. In the case of tulips, the object in view was to raise from the self-colored mother bulbs sports with striped or flamed flowers. The growers then propagated these vegetatively.

In 1860 the planted acreage was about 300 H. A.
In 1900 the planted acreage was about 2,500 H. A.
In 1932 the planted acreage was about 10,300 H. A.

In 1933 the economic crisis made its appearance and the export of the harvested bulbs was no longer possible. The Dutch Government, on request of the growers took drastic action—the cultivated area in tulips, hyacinths and narcissi was greatly reduced,—for daffodils, 50%, for hyacinths and late tulips, 35%, and for early tulips, 20%. With the outbreak of the war in 1939, the area was once more decreased by 50%, except for narcissi.

BULB EXPORTS

It is of interest to note that the United States of America, Canada, Newfoundland, Cuba and Mexico, imported hyacinths from Holland as indicated below:

In 1934, 14,021,000 bulbs
In 1935, 16,563,000 bulbs
In 1937, 19,204,000 bulbs
In 1938, 18,902,000 bulbs
In 1939, 20,725,000 bulbs

For early tulips the quantities were:

In 1934, 19,678,000 bulbs
In 1935, 20,480,000 bulbs
In 1936, 22,083,000 bulbs
In 1937, 21,739,000 bulbs
In 1938, 19,707,000 bulbs
In 1939, 19,920,000 bulbs

Late tulips, including also Mendel- and Triumph-tulips, were imported in the following quantities:

In 1934, 61,005,000 bulbs
In 1935, 66,318,000 bulbs
In 1936, 77,269,000 bulbs
In 1937, 88,546,000 bulbs
In 1938, 90,960,000 bulbs
In 1939, 107,010,000 bulbs

Daffodils were imported in the following quantities:

In 1934, 5,373,000 bulbs
In 1935, 6,011,000 bulbs
In 1936, 5,576,000 bulbs
In 1937, 8,812,000 bulbs
In 1938, 6,086,000 bulbs
In 1939, 12,082,000 bulbs

IMPROVEMENT OF VARIETIES

Already before the war the improvement in varieties was considerable, and as will be shown further on in this article, brilliant results have been obtained in spite of the fact that improvement during this Century was carried on only with great force of will. In the case of tulips, the Mendel and Triumph strains are good examples. In the early part of this Century there was a great lack of good tulips for forcing. There was a limited number of early tulips that would flower early in the season, for instance at Christmas and early in January, but generally the stems were too short for use as cut flowers. Then the hybridists of the firm E. H. Krelage and Son started the crossing of the very early Duc van Tol forcing strain with the long-stemmed richly-colored Darwin tulips. These crossings began in 1909 and in 1915 the first hybrids flowered. They had a longer stem and the coloration of the Darwin tulips. Only later was it possible to be sure that the aim in view was attained—to obtain early-forcing tulips with such long stems that they could be used for cut flowers. The hybrids were named Mendel tulips and several of them could be brought to flower about Christmas and especially about the first half of January. They then had stems from 12—16 inches tall. Another weighty advantage was that the period of forcing was considerably shortened, for good Mendel tulips can be brought to flowering in 20—24 days in a temperature of 60—65° F., and it is proved that two batches of Mendel tulips can be forced in the same time that it takes to force one batch of Darwin tulips.

One great mistake should be noted—in the beginning unselected Mendel tulips were marketed. It is a fact, that even in the best seedlings there are bad sorts, for instance with too weak stems, or with flowers not up to grade. The name Mendel tulips for a time was brought into ill repute in foreign countries. Now that gradually the chaff has been sifted from the wheat, it is proved that among the Mendel tulips there are some very good sorts, which are now in demand everywhere and give the best results to customers.

The Triumph tulips as a matter of fact had a similar history. Probably these originated by the crossing of early tulips with Darwin and Breeder tulips. In the beginning hundreds of varieties were brought into the market. Soon it was obvious that most of them were not suitable for forcing because they were too late and therefore had no advantage over Darwin tulips. Also the growth of the leaves was too heavy and the colors are too sombre. They were however suited to garden culture,

but it was evident that only the very best could be maintained. In the end—of the hundreds of varieties—a very small part was left. The final selections had the best qualities, and these now have a prominent place in the bulb trade.

In the early part of the Century, the Lily-Flowered tulips sprang from the crossing of *Tulipa retroflexa, T. elegans* and similar species with Darwin tulips. The flowers have a graceful form, looking very much like a lilium, and the first one distributed, *Sirene,* is still common in culture. The Lily-Flowered tulips have some difficulties in culture, but these too should be overcome in the future.

During the period when these new breeds came into being, the Darwin, Cottage, and Breeder tulips were not neglected. Even before the war improvements had been made. As will be shown further on in this article, the improvements were made due to a determined effort.

Since the early part of the Century daffodil culture was on a very high level, and the improvements in the flowers attained are so beautiful that it is hard to believe that so much beauty can be developed in the open without the shelter of hot-houses.

Also in the case of other subjects, as hyacinths, crocuses, etc., much was accomplished, and when the great war broke out all cultures were on the highest level.

BULB-CULTURE DURING THE WAR

Dutch bulb-culture could hardly keep its head above water during the five terrible war years as a consequence of the severe trials imposed by the Germans. It was very difficult to endure these years of oppression, for Dutch bulb-culture, even before the war, had to carry on a sharp struggle for life. In 1933 the economic crisis had shaken the whole international trade to such a degree, including also the bulb trade which depends entirely on export into foreign countries, that many growers pressed the Government for protective measures. High toll-bars were run up, import prohibited, quotas fixed, and in this way the export-amount declined to a critically low level. The cultures were drastically curtailed. Costly sacrifices had to be made by the bulb growers, but Dutch bulb-culture of ancient lineage was saved.

War came and the Netherlands were usurped by the Germans. Buildings and barns were requisitioned, stocks plundered, fortifications constructed in bulb-fields, workmen drafted, and very low minimum prices imposed on the sale of bulbs. By all of these measures bulb-culture was heavily struck. Nations which have not suffered under the stringent yoke of the Germans cannot possibly know what this means. The constant confidence of the Dutch people in the final victory of the Allies was the reason why the hostile occupants were not mighty enough to break the determination and will of the bulb growers. On one side the bulb growers applied themselves hand and soul to the production of food, on the other they were compelled to cultivate tobacco and other crops in order to keep body and soul together. And besides this determined struggle for "to be or not to be," the bulb growers applied themselves with tenacity and "élan" into the improvement of the bulb strains.

TULIP MUTATIONS, OR "SPORTS"

The improvement of bulbs had already been pursued purposefully and with great zeal for a long time in the Netherlands; in each domain important novelties were won, the new seedlings were critically judged by experts, some forced and similar bulbs grown in the open. In this way it is possible to separate the good from the inferior in a relatively short time and so select a quantity of good varieties.

As for tulips, new varieties were obtained from seeds or from "sports" of existing trade sorts. The latter method is very important, for in most of the cases a sport of a good trade sort is characterized by the same qualities as the mother sort. A good example is the Darwin tulip *Bartigon,* from which a number of good sports have sprung:—the glowful-red *All Bright, Campfire,* etc., the pink *Philip Snowdon, Prunus,* and others. *Queen of Bartigons,* one of the newest sports with salmon-pink color, is remarkable for in this sport the anthers are of another color, viz., yellow, while those of *Bartigon* are black. *Florex,* also is a magnificent pink sport and *Pink Attraction* too is an exceptional *Bartigon* sport. In foreign countries these sports are much in demand, because it is a fact that *Bartigon* is one of the best tulips for forcing and for the market.

The Darwin tulip *William Pitt* gave a sport with glittering red flowers: *Red Pitt,* which will surely make its way, having the same good qualities as the mother tulip for forcing as well as for the cooling-procedure. The sports of *William Copland* are already known: *Rose Copland, Copland Purple,* and the newest, *Copland Rival,* that outshines in pink the *Rose Copland.*

The tulip that undoubtedly has given the greatest number of sports is the Double Early Tulip, *Murillo.* Sports as *Electra, Mr. v. d. Hoef, Maréchal Niel, Oranje Nassau, Schoonoord, Peach Blossom,* etc., are well known. Less known are *Madame Testout,* a very fine pink; *Wilhelm Kordes,* orange; *Reingold,* deep yellow; *Aga Khan,* orange; *Goya,* bright salmon-orange outside; to mention only some with divergent colors. In pink and lilac there are a great many sports, only a fine red is still to be attained. The total number of *Murillo* sports is estimated at over 500. Such closely-related tulips are very valuable to the growers. They flower at the same time, are nearly all of the same height, qualities that are of much value for planting in pots. The whole lot is called: "Mother *Murillo* and her children."

White Hawk and *La Reine* too have many sports and among these such beautifully colored varieties as *Apricot Yellow,* buff yellow slightly tinted red and orange; *Golden Pheasant,* mahogany-red, edged golden yellow; *Orange Hawk,* carmine yellow and orange. All of these have the same good qualities of the "Mother," and are thus of particular usefulness for garden decorating.

Also very important are: *General de Wet,* orange, and *Prince Carnaval,* artistic combination of red and yellow, both sports of *Prince of Austria. Ellen Moore,* yellow striped scarlet, is a sport of *Fred Moore; Joffre,* a bright yellow, is a sport of *Brilliant Star.* There are many

others, but they are available at present only in small quantities.

All of the above mentioned sports represent changes in color, but the plant is like the mother-sort in all other characters. Another group of sorts excels by taller flowers with almost the same color as the mother-sort, as in *Bartigon max, Brilliant Star max, Crimson Queen max, Princess Elisabeth max, Le Nôtre max, Vermillon Brillant max,* etc.

A third group also keeps the same color, but the form is quite distinct. We refer to the Parrot tulips. *Blue Parrot* sported from the Darwin tulip, *Bleu Aimable* of the same color, but with much taller and fantastically formed flowers; *Black Parrot* is a sport of the Darwin, *Ph. de Comines; Discovery,* of the Darwin, *Princess Elisabeth; Gemma,* of *La Reine; Gadelan,* of *Sensation; Henrik Ibsen,* of the Triumph tulip, *Pluvia d'oro; Orange Favourite,* of the Cottage tulip, *Orange King; Pierson,* of the Darwin, *Allard Pierson; Red Champion,* of the Darwin, *Bartigon; Rex,* of the Single Early tulip, *Keizerskroon; Sunshine,* of the Cottage tulip, *Bouton d'Or; Thérèse,* of the Darwin, *Farncombe Sanders; Violet Queen,* of the Breeder tulip, *Opal.* Many others are also being propagated, but the supply is still very small. Thus quite a new assortment of Parrot tulips, great improvements over the older sorts, are ready to enrich gardens.

Still another group of sports is very important because these have different flowering seasons. From the Darwin *Bartigon* came a sport that flowers much earlier, and may be forced about Christmas. It is named *Murillo max,* an earlier flowering sport of *Murillo,* with taller flowers. *Christmas Bartigon.* Such sports originated also from other tulips, for instance, *Early v. d. Hoef,* a very early flowering sport of *Mr. v. d. Hoef; Aristan,* an early flowering form of the Double Early tulip, *Triumphator;*

TULIP HYBRIDIZATION

By means of hybridization many choice new tulips were obtained which will bring about a real revolution as soon as a sufficient stock of them is available. One of the most interesting crossings was that of *Fosteriana Mad. Lefeber* with Darwin tulips. The hybrids have very tall stems like the Darwins and big flowers in the form of the father tulip. The colors are fantastically beautiful, ranging mostly from violet red to vermilion red. Foremost among these is *Holland's Glory* with enormous stems and big brilliant-red flowers. *Lefeber's Favourite* perhaps is somewhat smaller, glowing scarlet-red, but gets closer to the Darwin type. The last was magnificently in flower this year (1947) in the early part of February. We mention only two hybrids, but there are more of them.

Mendel tulips x *Fosteriana* too gave a hopeful result. The flowers are big, the stems solid and the flowering time is somewhat earlier than in the case of the above mentioned crossings. One of the most beautiful hybrids from this crossing is *Red Matador,* with violet-scarlet color. It is beyond doubt that in this strain there is still more to be expected in the near future. *Tulipa Kaufmanniana* and *T. Greigii* have also played a great part in the improvement. Their crossings gave a number of hybrids with flowers formed like *T. Kaufmanniana* and the beautifully spotted leaves of *T. Greigii.* The first hybrids, such as *Gluck, Robert Schumann*

and *Vivaldi* are rather well known, but they are surpassed by *Alfred Cortot,* glowfully red, black basis; *Henriette,* white, basis red and black; *Johan Strauss,* white, outside with red; *Josef Kafka,* dark golden-yellow inside, outside bright red with golden-yellow; *Jacques Thibaud,* yellow, outside red; *Shakespeare,* salmon colored; *Sweelinck,* uniform soft yellow, small red blotches at the tip of the petals, etc.

The number of new tulips for garden use is very large, but apart from the above mentioned sports of Single Early and Double Early tulips, nothing in particular needs to be mentioned in these sections. Nevertheless, it will be appropriate to turn our attention to the Single Early tulip, *Adjutant,* with big scarlet-red flowers, which can be forced early. Also to *Bel Ami,* deep rose with white base, that can be brought into the hothouse as early as December 15; *Bellona,* bright yellow, tall solid stem, quite new; *Orange Marvel,* lively deep orange, splendid color; *Oranje Vaan (Fred Moore* x *Vermillon Brilliant)* with very warm orange-red color.

Among the Double Early tulips, *Engelenburcht* has come to the front this winter, with pure white flowers and long stems; and also *Hoangho,* bright golden-yellow, with a first quality stem and well shaped flowers.

The Mendel tulips are more and more nearing perfection. *Her Grace,* deep lilac-rose and white, is already known, but every winter it becomes more obvious, that it is a quite distinct and superior tulip also for bedding. *Athleet* ought to have been mentioned among the sports, it is pure white and is a sport of *Weber.* Undoubtedly it is one of the most beautiful white tulips in the last half of January. Without doubt it will soon take the place of *Fred Moore* and like *Gertrude Carlee,* has a distinct salmon-rose color, somewhat brighter than that of the well known Darwin tulip, *Clara Butt,* a tint which certainly will attract attention. *Olaf* has a violet scarlet-red color and is particularly strong. *Orange Wonder* is one of the very finest tulips, also in the open, deep orange-red and orange edged. *Peerless Pink* fascinates by the fine silvery-rose color, the big flowers and strong stems. *Pink Trophy,* deep rose, is in all respects a shiner and can be forced early. *Topscore* is sparkling red, a most beautiful color. *White Grace* is a pure white sport of the already mentioned *Her Grace* with all the good qualities of the mother tulip; and finally *Yellow Gem,* pure yellow, should be noted.

Great improvements have also been obtained in the Triumph group. *Aureol,* for instance, is a magnificent sport of *Elmus* with bright red flowers, orange-yellow edged; *Beator* is a strikingly beautiful pink, with well-shaped flowers. *Bruno Walter* is of quite a different style, bronze-orange, a very distinct color that had not as yet been met with; *Golden Wonder* is no longer so new, but the big deep-yellow colored flowers indeed are a wonder. *Glory of Noordwijk* is deep lilac-rose and white, very strong, a distinct tulip, though the color is somewhat hard. *Nivea,* pure white, is excelling by very big flowers on tall strong stems; it is not easily to be beaten in the second half of February. *Robinia* is dark red and many people regard this tulip as an improvement over the single Early tulip *Couleur Cardinal,* the more so since it grows better and can better be forced. *Patria, Red Signal* and *Red Giant* are three brilliant

tulips in violet-red color. The future will show which of the three is the very best, also with respect to garden decoration. *Pax* is pure white and a first class tulip, either for forcing or the open air. *Pierre Monteux* excels by a glowful purple that had not as yet been seen in this group. *Richard Strauss* too has a distinct carmine-red color, and is very fine under artificial light, and also in the field. *Reforma* has a soft yellow color and particularly big flowers. Last we must mention *Wintergold,* pure yellow, somewhat sharp-pointed flowers, but long lasting.

The Double Late tulips are best in the cold hot-house. There the big flowers develop into Peony-like flowers. In this group many improvements have been obtained in the last several years. However, time must show which are the most valuable for general use. In our opinion, the following are most promising: *Granada,* deep rose; *Orange Triumph,* warm orange edged and a sport of *Coxa; Pink Fancy,* beautifully shaped, lilac-rose; *Racket,* a red sport of *Eros;* and *Royal Yellow,* a deep yellow sport of *Bouton d'Or.*

The improvements in the Darwin group are enormous, and it is difficult to make a good choice. In doing so, we must consider the grower's ideal in order to select all-purpose varieties that are not only magnificent garden tulips but also have good forcing qualities. Many experiments must be made in order to confirm this, and it is not certain as yet whether all of these new seedlings are all-purpose tulips. However, we are of the opinion that the sorts mentioned below will surely give satisfaction though we are conscious of the possibility that others may also be as good.

Ace of Spades is a very dark brown-red tulip, excellent for forcing and of particular value for special purposes of garden decoration. Quite different is *Ambon,* pure yellow, with very strong stems. For shape and bigness of flower one could call it a yellow *Bartigon. Aristocrat* is no longer very new now, but has proved its excellent qualities for forcing, and satisfies the demand for garden decoration. The color is soft purplish-violet-rose. *Baden Powell* is a fine bright salmon-red, a tint that satisfies the exacting demands of artificial light as well as sunshine in the open air. *Bismarck,* violet-red is excellent for forcing, but is less to be recommended for the garden. *Capitol,* one of the very best white tulips for forcing, is much to be recommended for garden decoration. The pollen is black. *Dementer,* the strange Darwin tulip that can be forced very early, excels by a reddish-purple color, a tint of great value for particular purposes, such as grave decoration. *Desiree* is one of the most beautifully colored vermilion-red tulips with first class qualities for forcing and garden decoration. *Dorrie Overall* too, light petunia-violet edged lilac-mauve, with big broad flowers on 25 inch stems can easily be forced about February 15, and is a welcome addition to the lilac color section. *Eminent* is a tulip for garden decoration. The enormous flowers are dark old-rose, tinted salmon-rose. The stem is about 20 inches tall. *Jo Warnaar* probably is a sister of *Desiree.* The color is deep scarlet-red and though *Desiree* perhaps is superior for garden decoration, *Jo Warnaar* is better for forcing. It can be in flower in early January. *Juweeltje* is notable for a deep madder-red, when forced, almost orange. It may be flowering

about February 15. *Mamasa* is one of the very best yellow Darwin tulips. The color is dark butter-cup yellow and the flowers are big and solid-shaped. *Neerlandia,* when forced, is pure salmon-rose, in the open air, carmine-rose with a salmon glow. It can be in flower by the end of January. *Nobel* fascinates by a big broad flower with violet-geranium sealing-wax color. The stems are 30 inches tall. For the garden it is a brilliant acquisition. *Paul Richter* also can be in flower about January 15. The color is a wonderfully beautiful geranium sealing-wax red with an orange glow. *Queen of Night,* the blackest tulip, which can be forced in the second half of February, is most valuable for garden decoration. *Rosa v. Lima* has an exceptional color—lively lilac-rose with a narrow salmon colored rose brim and could be regarded as a *William Pitt,* diverging in color. It can be forced into flower in the last part of January. *Scarlet Sensation* has already proved year after year to be a magnificent scarlet-red tulip that can be forced somewhat earlier than *Bartigon. Sweet Harmony* is a sport of *Mrs. Grullemans,* but it has a distinct color, suggesting that of the old single Early tulip *Brunhilde*—pure lemon-yellow with ivory-white edge.

In the Breeder and Cottage groups there are numerous novelties that may soon receive more attention, but at this time they are still in the testing stage. We make an exception for the Cottage tulips, *Kleurenpracht* and *Vlammenspel,* both yellow with red flames, and both sports of *Inglescombe Yellow.* They flower very late, and for garden decoration these warm-colored tulips are exceedingly beautiful.

Very valuable selections and hybrids are to be found among the *Tulipa* species, but these have been mentioned above.

HYACINTH BREEDING

The propagation of hyacinths is difficult, but it is still more difficult to obtain improvements by breeding methods over the existing varieties that are characterized by rather uniform flowers. It is important above all to obtain varieties with large well-shaped spikes, and that satisfy at the same time the most exacting cultural demands. They must also be suited for preparation methods so that they can be brought into earlier flowering. In spite of the difficulties involved in hyacinth breeding, progress has been made. Some very good varieties have been obtained, such as the pure white *Edelweiss;* the beautiful *Ostara,* blue; and the warm rose *Anna Marie.* In the near future however other fine varieties can be expected in various tints from bright to dark blue, from carmine to scarlet-red, from yellow to orange, from rose-white to very warm rose, etc. During the last couple of years we have seen most promising results that give us grounds for looking to the future development of the hyacinth with optimism.

NARCISSUS BREEDING

The modern daffodils are noble in form and rich in color. Formerly daffodils were available only in yellow and white colors, but now there are varieties with orange, or red cups. The Dutch growers however did

not confine themselves to the objective of obtaining orange or red cups, on the contrary, they always had a feeling that the big trumpet *Narcissus* would remain among the favorites. The big trumpets are of special importance for forcing, though even here good colored orange and red cups are playing their part.

By means of scientific experiments, daffodil forcing has been revolutionized. Once one did not expect beautiful daffodils before mid February. Early forcing results were expected from varieties that are inclined by nature to come early into flower. There are trumpet *Narcissus,* for instance, *Magnificence,* that can be flowered as early as the first days of January. With most varieties this is not possible and for this reason it is of interest to mention that scientific experiments with the cooling process made it possible to have flowering daffodils as early as the end of November. Although the superior novelties are numerous, there are not so many real favorites that satisfy the highest requirements for every purpose. Among the yellow trumpet-daffodils, *King Alfred* was for a long time the very best, although a free bloomer it does not come up to the highest mark. Then came *Golden Harvest* with very big flowers, golden yellow and fine form. Because of its large flowers, and free-flowering and early forcing habits, it will gain increasing popularity. *Magnificence* too has excellent qualities; first of all because of its early-flowering habit, and also because of the very beautiful deep yellow color of the flowers. *Rembrandt* could best be called an improved *King Alfred,* and *Insurpassable* is remarkable for exceedingly large flowers. Other novelties offered of late are *Covent Garden,* uniform yellow, fine form—in our opinion a first class flower for the trade. *Decency,* a medium large clear yellow daffodil of perfect form which can be forced rather early. *Godolphin* is already well known and is admired because of the uniform yellow color. *Golden Sunrise* is a good bright yellow daffodil, free-flowering. *John Farquhar* excels by large flowers with a sulphury-yellow perianth and deep yellow trumpet. *Louis Bouwmeester* is one of the darkest yellow daffodils, belonging to the early kinds for forcing. Among the new promising yellow trumpets are: *Flower Carpet,* a very free-flowering rather deep-yellow one, regarded as a great improvement over *King Alfred. King Albert, Lutine, William the Silent* are three closely related varieties with tall, well-formed flowers and rich yellow color. *Mulatti* is distinct lemon-yellow on sulphury-yellow background—an attractive color.

The bicolor-trumpet group too urgently needs improving, for the old kinds as *Glory of Sassenheim, Spring Glory, Victoria* have some faults. Although it is very difficult to obtain improvements in this group, *Queen of Bicolors* with creamy-white perianth and tall yellow trumpet is a distinct advance, especially with respect to the free-flowering habit. *Bonython* is beautifully shaped, has a bright white perianth and sulphury-yellow trumpet, and to our view is very promising. *Lotta Svard* will probably prove to be a very good bicolor for the trade. It is free-flowering, and the perianth is bright white with golden-yellow trumpet. *Norway* may be a good substitute for *Victoria* if it can hold

up under the exacting cultural tests. *President Lebrun* is a very beautifully-formed bicolor with a bright white perianth, and lemon-yellow trumpet passing to creamy-white. *Patria* has big well-formed flowers with magnificent deep-yellow trumpet.

White trumpet daffodils have always been scarce. The old *Peter Barr* and *Madame de Graaff* have held up their names rather a long time, but after all the flowers did not satisfy the demands that could be required from white daffodils. *Mrs. E. H. Krelage* is of far better quality and is still being cultivated in large quantities. The form of the flower is perfect, but the trumpet is more or less sulphury-yellow. A great improvement is *Beersheba,* pure white and of exceptionally fine shape. *Imperator* has tall flowers, an excellent shape, and a very attractive creamy-white color. *Mount Hood* is a very good white trumpet daffodil, free flowering, and fades to pure white after some days. *Romaine* has very large well-formed flowers that are creamy-white. *Roxane* is older; it makes a good show because of the large flowers. Finally, *Stresa,* with large creamy-white flowers on tall strong stems may be mentioned.

The incomparabilis group could best be divided into two parts—giant-incomparabilis and those with smaller flowers. The giants have the most attraction for the trade. First consideration is given to *Fortune,* with stems as tall as those of the trumpet daffodils and enormous flowers too. The perianth is deep yellow and the very large trumpet-shaped cup is fine orange. A bunch of flowers of this *Narcissus* attracts buyers. During forcing however one has to be careful with high temperatures lest the cup should fade. *Carlton* also has very large flowers on long, strong stems with sulphury-yellow perianth and clear yellow cup. *Monique* is midway between the giants and the smaller flowers, but is in all respects a very beautiful daffodil with white perianth and golden-yellow cup, edged orange. *Scarlet Leader* also is on the midway line, although it has a large flower. It is a brilliant variety with white perianth and bright red cup. *Solario* is a real giant with pure white perianth and large canary-yellow cup. Well-developed flowers of this variety are not inferior in size to those of a bicolor-trumpet. *Sempre Avanti* has large flowers with creamy-yellow perianth and bright orange cup.

Among the incomparabilis with smaller flowers there are many varieties of high standing, as *Aranjuez,* medium large, light yellow perianth, large orange cup, edged red; *Bartizan,* medium size, perianth bright yellow, cup orange red; *Deanna Durbin,* medium size, perianth white, cup light orange; *Edward Buxton,* medium large, light yellow perianth, deep orange cup; *Gold Cresh,* medium size, perianth bright yellow, large orange cup; *Killigrew,* medium size, perianth yellow, cup light orange; *Scarlet Elegance,* medium size, perianth deep yellow, cup deep orange-red, a very fine color.

The newest and most promising incomparabilis is *Flower Record,* exceedingly free-flowering, with white perianth and dark yellow cup, red edged. It is particularly beautiful and excellent for the trade because it is free-flowering. The Barrii section is actually surpassed by the incomparabilis. Generally the flowers are smaller. *John Dix,* however,

flowering rather late with bright white perianth and dark red cup, is very much to be recommended for garden decoration. *La Riante* with clear white perianth and rather large flat red cup is recommended for it can be easily forced. *Verger,* medium large, perianth pure white, deep red cup, is very meritorious and will replace *Firetail.*

In the poeticus section, after *Actaea* and *Sarchedon,* few conspicuous varieties have been offered although there are notable new ones which may be included in the larger assortments.

The Dutch growers have had success in producing double daffodils, especially for forcing. *Texas,* with very large flowers, yellow color, shaded with fiery orange, is one of the best, and will undoubtedly play a great rôle in forcing. *Indian Chief,* also a large-flowered, yellow with orange, and *Mary Copeland,* white with deep orange-red, are very promising. A remarkable novelty, a sport of *Cheerfulness,* with delicate yellow flowers, will come to the foreground in the near future.

Of the poetaz daffodils there are already many, but *Geranium,* with large flowers, pure white with deep orange-red cup and very well-formed umbels is a very good advance. It does not bloom very early but by the end of February one can have magnificent specimens. *Cragford,* of English origin, the stock of which is in Holland, is one of the most interesting varieties that we know. Without cooling we can have magnificent flowers of it at Christmas. This variety can be forced into flower in water. The stock is not very large, but when available *Cragford* will be one of the daffodils most in demand, perhaps it will compete with the "Paper-whites."

Golden Perfection is a very large-flowered jonquil hybrid, shiningly golden-yellow in color. *Thalia, Moonshine* and *Laurentia,* are extra fine triandrus hybrids, with three to four white flowers to the scape.

VARIOUS BULBOUS PLANTS

With reference to other bulbous plants, the Dutch growers can also report progress, either by crossing or by importing species from other countries. For instance, *Acidanthera Murielae* was imported from western Abyssinia. It is about 30 inches in height, and on every stalk has several sweetly scented large white flowers with a crimson maroon blotch. The culture is very easy and like that of gladiolus.

Colchium. The meadow saffrons too are enriched with magnificent novelties such as *Lilac Wonder,* uniform violet-mauve, most free-flowering; *Premier,* soft pinkish, mottled mauve, large white center; *The Giant,* dark lilac-mauve with a magnificent white base, rather late; and *Waterlily,* with full double flowers, with a brilliant lilac-mauve color.

Crocus. The diversity in the large-flowered Crocus has always been very great and the Dutch growers do not rest on their laurels but are trying to produce still better varieties. However, it is very difficult to surpass such fine sorts as *Early Perfection,* violet purple-blue; *Excelsior,* fine lilac-blue; *Niggerboy,* uniform very dark lilac; *Paulus Potter,* very distinct deep magenta; *Remembrance,* purple blue, very large; *Snowstorm,* pure white. In the near future there will be improvements, as

Jeanne d'Arc, large-flowered white, and *Cinderella,* purple striped on soft ground. A very distinct *Crocus* is *Vanguard,* soft violet-blue on the outside and sulphur inside; it flowers two to three weeks before the other large-flowered ones, and is a fine garden subject.

New and beautiful varieties have been obtained in the spring-flowering *Crocus* species. *C. chrysanthus E. Aug. Bowles* has nicely-shaped round flowers that are butter-yellow, and bronze-grey outside; *C. Balansae* var. *Zwanenburg* has small round, very dark-orange colored flowers; *C. Tomasinianus* var. *Zwanenburg* reminds one of *Vangard* but in our opinion it is still finer and more free-flowering.

Eranthis. A great advance has been made by the introduction of the new *Tubergeni* hybrid with shining golden-yellow flowers. It is much taller than *E. hyemalis* and *E. cicilica.*

Freesia. Recently numerous magnificent *Freesia* novelties have appeared. Rijnveld's *Golden Yellow* is particularly good. The large flowers are golden yellow with orange blots, and they have stalks reaching, in the glass-house, to the height of 30 to 40 inches. *Caro Carlee,* already in the trade, has large creamy flowers on strong stalks, and it is especially valuable for decorative purposes. *Glorious Victory* is deep yellow with orange and has the shape and lasting qualities of *Buttercup. Nieuw Amsterdam* has large, far outstanding flowers, soft lilac-pink with white base. *The Bride,* pure white, is one of the very best of the well known white varieties.

Gladiolus. No flower is more popular in summer than the gladiolus and for about 30 years the Dutch growers have applied themselves heart and soul to their improvement. The number of varieties is perplexingly great, and we are considering a few of them briefly. *Alpenklokken,* pure white; *Bellona,* soft yellow, magnificent spikes; *Je Maintiendrai,* glowing-red, unsurpassable color; *Joh. v. Konijnenburg,* nice light garnet-red, unprecedented, fine color; *Leeuwenhorst,* particularly large-flowered, 8 flowers open at the same time, vividly pink colored; *Majuba,* glowing-red with vermilion-red glow; *Mansoer,* dark auburn, enormous flowers; *Marathon,* deep rose, tall, well-formed flowers on long strong stems; *New Europe.* glowing vermilion-red with scarlet glow; *Normandie,* magnificent pink, flowers on long stems; *Paul Rubens,* the most beautiful lilac-purple; *Pink Giant,* soft rose, very large; *Radiance,* distinct warm velvety-scarlet, medium large; *Ravel,* the best lilac-blue with perfectly-shaped flowers on very tall stalks; *Salmon's Glory,* one of the biggest with enormous flowers of pink-white color with a red blotch; *Salmon Joy,* with medium large flowers, exceedingly fine salmon-orange; *Sonja Henie,* white with a large red spot, very large; *Sweet Seventeen,* finest silvery pink, nicely waved flowers; and *Vincent van Gogh,* dark salmon-pink-white and carmine in the throat, with large cups.

Iris. Especially the Dutch iris have been much improved. Flowers of increased size and fine colors are found in *Alaska,* uniform deep canary-yellow; *Albino,* pure white; *Belle Jaune,* deep golden-yellow; *Bronze Queen,* standards mauve-violet, falls bronze, spotted orange; *Golden Emperor,* dark yellow; *Harmony,* standards pale blue, falls yellow, fine

combination of colors; *Jeanne d'Arc,* the very best creamy-white; *Mauve Queen,* uniform lilac-mauve; *Oranje Vaan,* beautiful orange; *Princess Irene,* the most beautiful variety raised, the standards pure white and the falls deep orange; *Subliem,* bright blue; and *White Trophy,* pure white. There are still other fine varieties, and when these enter the trade, the older ones will be superceded.

Lilium. Some growers are busy producing good lilium novelties. A number of good ones have already been raised, but the greater part have not as yet been named. There is one exception, *Queen Wilhelmina,* with rather large flowers, white with clear orange center, a color combination never seen before in *Lilium.*

Scilla. Very important varieties have been obtained, for instance *Scilla sibirica* var. *Spring Beauty,* a very fine form of the old species, with larger flowers and a brighter blue. This Squill is very suitable for wild-gardening and for the rockery, but it can also be forced in February. In that case it forms nice material for pots and baskets. Another outstanding Squill is *S. Tubergeniana* introduced from North Persia, but now growing with success in Holland. The color of the flower is delicate greyish-lilac and there are three or more spikes on each strong bulb; every spike bears many lovely flowers. This Squill is a fine addition for the rockery and wild-gardening.

In the so-called May-flowering scillas, such as *S. campanulata,* very fine novelties have been raised. The flowers of these new-comers are much larger than those of the older varieties, and the spikes are much stronger and bear more flowers. Some of the best are: *Blue Pearl,* amethyst-blue, broad spikers; *Blue Ribbon,* violet-blue with purple tint; *Myosotis,* sky-blue; *Queen of the Pinks,* lovely violet-rose, very large; *Rosabella,* soft lilac-rose, extra; *White Triumphator,* pure white.

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BRIMBLE'S "FLOWERS AND TREES IN BRITAIN"

HAMILTON P. TRAUB

That the British have reached cultural maturity long ago is evidenced by the general appreciation of ornamental plants in the British Isles. In the past, many fine popular treatises on gardening have appeared in Britain, and now we have the pleasure of reviewing briefly two outstanding companion volumes on "flowers and trees" in Britain,[1] by L. J. F. Brimble, joint Editor of NATURE (London) and formerly lecturer in the University of Glasgow and Manchester.

The first volume, "Flowers in Britain," is concerned with ornamental herbaceous plants and shrubs, and the second, "Trees in Britain" treats primarily of trees. By a stroke of genius he has brushed aside the usual rigid and illogical separation between "flowers and trees" and thus has produced two companion volumes that unify the outlook of the ornamental gardener. It is therefore recommended that the two volumes be used together for it is time to realize that "a mere allusion to trees is not enough for the reader who wants a comprehensive view of flowering plants."

The volumes are written in a clear and pleasing style "for anyone who is interested in or wants to know something about flowering plants," including the "structure of plants, their classification, habit and habitats." Mr. Brimble also emphasizes "the part played by plants in folklore and above all their rôle in literature."

Within each volume, Br. Brimble has adopted the sound unifying principle of arranging the plants under their botanical families, and in this connection he has had the inspiration to adopt Dr. Hutchinson's classification (1926, 1934) with some slight exceptions.

The illustrations in the two volumes total no less than 368. In the first there are 18 colored plates, and 167 black and white text figures; in the second, 8 colored plates, 58 black and white plates, and 117 black and white text figures. But the generous quantity is not the important fact about these illustrations. Their content and quality is outstanding. This is especially true of the colored plates, and the many black and white portraits of trees.

The plant subjects included are not only those native to the British Isles, but also many other forms from other lands are considered, especially those that have found a congenial home in Britain. The subject matter therefore is of immediate interest to those living in other areas of the Temperate Zone.

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1 L. J. F. Brimble. **Flowers in Britain; Wild, Ornamental and Economic; and some Relatives in Other Lands.** Macmillan & Co., St. Martin's Street, London. First issued 1944; reprinted 1945, 1947.

L. J. F. Brimble. **Trees in Britain; Wild, Ornamental and Economic; and some Relatives in Other Lands.** Macmillan & Co., St. Martin's Street, London. 1946.

NOTE.—Both volumes may be obtained from Macmillan Co., 60 Fifth Ave., New York 11, N. Y.

Mr. Brimble has produced two volumes that will add immeasurably to the enjoyment and appreciation of plants by anyone interested. The acquisition of these volumes can be considered as a worth while investment that will yield liberal dividends.

JAEGER'S "A SOURCE-BOOK OF BIOLOGICAL NAMES AND TERMS"

HAMILTON P. TRAUB

This book by Edmund C. Jaeger on the subject of biological names and terms [2] will appeal to all interested in the biological sciences. To the plantsman, for example, who wishes to determine the meaning of scientific plant names, it will prove to be a veritable mine of information. To the trained scientist, its usefulness is readily apparent. It is a book in which "are alphabetically listed fully 12,000 elements from which scientific biological names and terms are made. With them are given their Greek, Latin, or other origins and their concise meanings, together with numerous examples of their use in scientific nomenclature." It also contains concise sections on the elementary principles of word-building, and the types of names considered. For those who are unacquainted with the Greek Language, the basic Greek words for combining forms have been translated into English. Mr. Jaeger is to be congratulated on an excellent job.

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2 Edmund C. Jaeger, **"A Source-Book of Biological Names and Terms."** Ed. 1. Charles C. Thomas, Publisher, 301-327 East Lawrence Ave., Springfield, Ill. 1947, 2nd. printing. pp. 256; 96 figures. $3.75.

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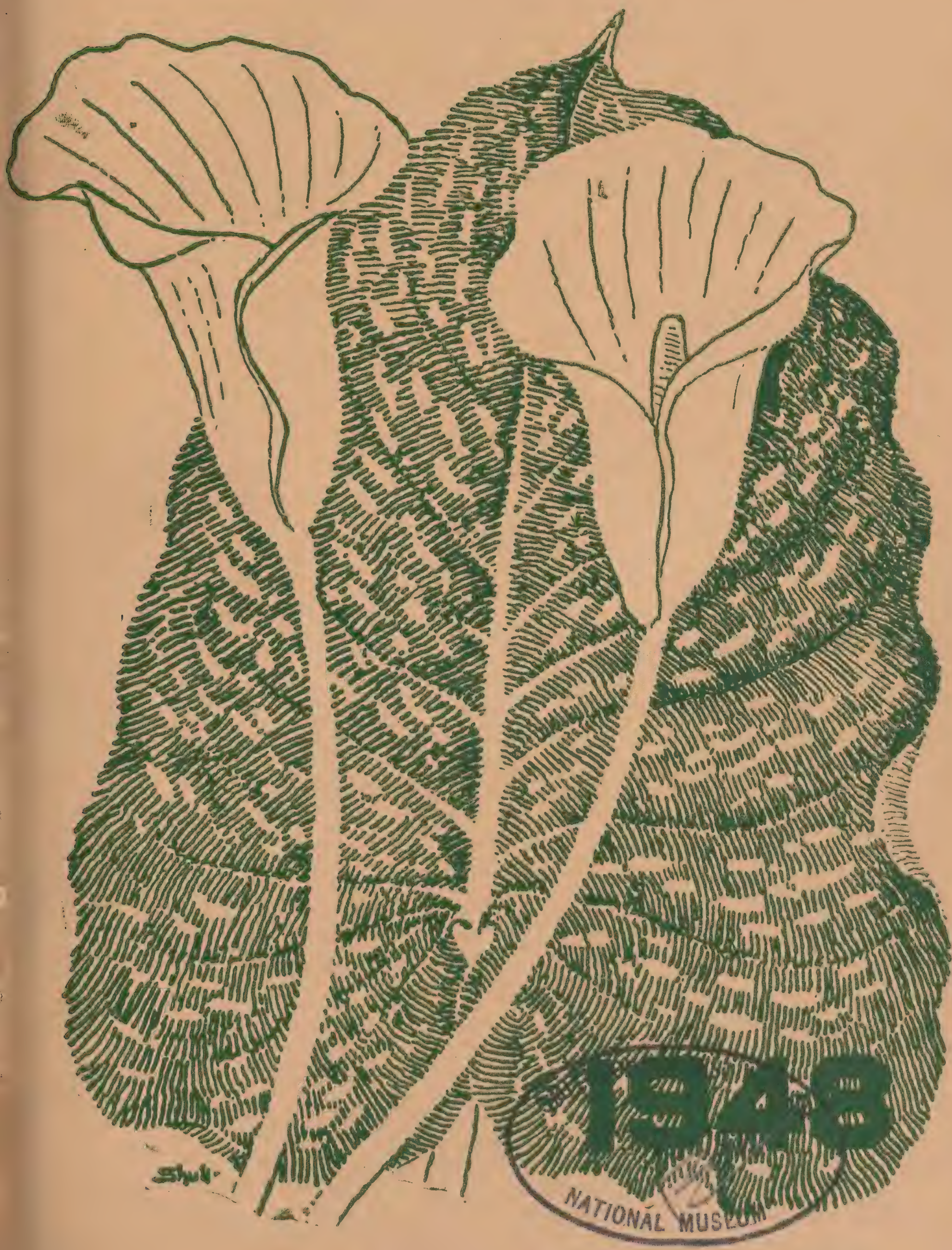

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PLANT LIFE

VOLUME 4

[Nos. 1—3: Jan., Apr., & Jul.]

1948

AROID LILY EDITION

Edited by

Hamilton P. Traub

Harold N. Moldenke

THE AMERICAN PLANT LIFE SOCIETY
Box 2398, Stanford, California

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PREFACE

PLANT LIFE for 1948 is devoted to the AROID LILY, genus *Zantedeschia*. The AROID LILY COVER DESIGN, based on *Zantedeschia Elliottiana*, represents the last and unfinished artistic work of the late J. MARION SHULL, who died unexpectedly of cerebral hemorrhage on September 1, 1948, at the age of 76 years. Although the design was unfinished, it was far enough along so that it could be used for its intended purpose. The original plan was to have a two-color cover—green and golden yellow—but since the design was not completely inked in, and it would have been necessary to add greatly to the work to complete it, it was thought best to reproduce the cover just as MR. SHULL left it in black and white as a memorial to him. The autograph was taken from one of his earlier designs, and the lettering was added by the editor, otherwise it is just as MR. SHULL left it. The sudden death of MR. SHULL came as a shock to all who knew him, and who will miss him very much. MR. SHULL'S autobiography and portrait were published in HERBERTIA 10(1943): 29—33, pl. 243. 1944, to which the reader is referred for information about his long and brilliantly useful career. The reader is also referred to MR. SHULL'S last article—on Kodachromes—which was completed only a short time before his death, and which appears in HERBERTIA 1948.

The FIRST AROID LILY EDITION of PLANT LIFE is appropriately dedicated to the late N. E. BROWN, the monographer of *Zantedeschia* in FLORA CAPENSIS and FLORA OF TROPICAL AFRICA.

The available representatives of the genus *Zantedeschia*, the AROID LILY or CALLA LILY, have been popular pot plants in northern Europe and American gardens and homes, and they are grown out of doors in warmer climates, particularly in Florida, California and Australia. The AROID LILY is also a valuable cut flower. Unfortunately there was no convenient up-to-date *Zantedeschia* reference source and for this reason the ARACEAE COMMITTEE of the SOCIETY was requested to furnish the needed articles to make good the deficiency. These articles are published in this FIRST AROID LILY EDITION of PLANT LIFE.

The genus *Zantedeschia* is a relatively small one, including eight or nine discovered species. N. E. Brown reduced *Z. macrocarpa* Engl., to the synonomy of *Z. angustiloba*, and this disposition is recognized in the systematic treatise of the genus included in the present issue. However, it is hoped that Dr. Dyer or one of his associates, who has access to living material in the native habitats, will give us an appraisal of the relative status of *A. angustiloba* and *Z. macrocarpa*, and also *Z. hastata*, all of which are not well known in America.

In the systematic treatise an attempt is also made to include a descriptive catalog of the cultivated forms, including hybrids. There is now an active group of AROID LILY hybridizers in America and Australia, and the future development of this group as a garden and pot plant is very promising.

In addition to the systematic treatise of the genus *Zantedeschia*, this issue contains interesting articles on the *Zantedeschia* industry by

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Messrs. Danks (Australia), Butterfield (California), and Hayward (Florida). Mr. Mirzwick (California), a specialist in the *Araceae,* contributes an interesting article on *Zantedeschia* and other *Araceae,* and Mr. Longmire (California), a specialist in *Zantedeschia,* favors us with a note on the introduction of a *Zantedeschia* species.

For the future, the ARACEAE COMMITTEE plans to furnish ARACEAE material for additional issues, including *Zantedeschia, Anthurium, Caladium, Arum,* etc.

Hamilton P. Traub
Harold N. Moldenke

September 15, 1948

TABLE OF CONTENTS

Page

Aroid Lily Edition Cover Design, unfinished work of the late Marion Shull, based on *Zantedeschia Elliottiana.*

Preface 3
Note for Plant Life—Herbertia contributors 6
Corrigenda for Plant Life, vol. 2 (1946) 1948 6
Corrigenda for Plant Life, vol. 3 (1947) 1948 6
Dedication 7
The genus *Zantedeschia,* by Hamilton P. Traub 9
Zantedeschias from French Equatorial Africa, by A. A. Longmire 32
The Aroid Lily *(Zantedeschia)* in Australia, by Fred M. Danks 33
The *Zantedeschia* (Calla) Industry in California,—
by H. M. Butterfield 34
The *Zantedeschia* (Calla) Industry in Florida,—
by Windham Hayward 36
Zantedeschia and other *Araceae,* by Len Mirzwick 41
Addenda 46
Hybridizing of Zantedeschia 46
Index to genera and species 47

ILLUSTRATIONS

PLATES

Plate 1. *Zantedeschia aethiopica* (Linn.) Sprengel 8
Plate 2. *Zantedeschia albomaculata* (Hook. f.) Baillon 15
Plate 3. *Zantedeschia angustiloba* (Schott) Engl. 17
Plate 4. *Zantedeschia Rehmannii* Engl., *Z. albomaculata* (Hook. f.) Baillon, and *Z. macrocarpa* Engl. 18
Plate 5. *Zantedeschia hastata* (Hook. f.) Engl. 19
Plate 6. *Zantedeschia Elliottiana* (Knight ex W. Watson) Engl. 21
Plate 7. *Zantedeschia melanoleuca* (Hook. f.) Engl. 23
Plate 8. Part of Mirzwick *Araceae* collection, and *Zantedeschia* beds 40
Plate 9. Mirzwick *Zantedeschia melanoleuca* beds, and specimen of *Z. angustiloba* (syn.- *Z. Pentlandii)* 43

TEXT FIGURES

Figure 1. *Zantedeschia aethiopica* (Linn.) Sprengel 12
Figure 2. *Zantedeschia Rehmannii* Engl. 27

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves*, *scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

CORRIGENDA FOR PLANT LIFE, VOL. 2 (1946) 1948

Page 5, 2nd entry under Table of Contents, change "on" to "for."

Page 87, 18th line from bottom, for "Francis" read "François."

Page 100, 12th line from bottom, in both instances, for "Agaveae" read "Agavaceae."

CORRIGENDA FOR PLANT LIFE, VOL. 3 (1947) 1948

Page 2, under directions about citations to this issue of PLANT LIFE, 2nd line, after "1—3" insert "(1947)."

Page 41, 4th paragraph, 1st line, for "Br." read "Mr."

Dedicated to N. E. Brown,
the monographer of *Zantedeschia* in
Flora Capensis and Flora of Tropical Africa.

Zantedeschia aethiopica (Linn.) Sprengel

THE IMMACULATE AROID LILY. One of the early illustrations of the type species, genus **Zantedeschia** Sprengel, reproduced from Bot. Mag. Lond., Plate 832. 1805. See Figure 1, for morphological details.
Plate 1

THE GENUS **ZANTEDESCHIA**

HAMILTON P. TRAUB

The genus *Zantedeschia*, commonly known as AROID LILY or CALLA LILY, belongs to the Arum Family *(Araceae)*. It is a relatively small genus with only eight or nine species, all native to Africa.

In the first edition of Species Plantarum, 1753, Linnaeus included two species under the generic name, *Calla* Linn. One of these, *Calla palustris* Linn., is an aquatic species native to the Northern Hemisphere, and the other, *Calla aethiopica* Linn., represents a non-aquatic species native to South Africa. We now know that these two species are not closely related, and did not properly belong to a single biologic genus. Kunth therefore proposed the name *Richardia* Kunth (1818), non Linn., to accommodate the South African species. Unfortunately, this name was already occupied by the Linnean genus *Richardia* Linn. *(Rubiac.)*, and another name, *Zantedeschia* Sprengel (1826) was later adopted to accommodate the type, *Calla aethiopica* Linn. This is obligatory since Linnean generic names cannot be switched around so as to mean something different than originally intended.

After Linnaeus proposed the type species, *Calla aethiopica* Linn., in 1753, more than a hundred years elapsed before Hooker f., proposed the second species, *Richardia albomaculata* Hook. f. (1859). In addition, more than ten other species have been proposed. Some of these have passed into synonomy by common consent; some, including *Richardia hastata* Hook. f. (1860), (syn.- *Calla? oculata* Lindl., 1659, nom. prov.), *Richardia melanoleuca* Hook. f. (1869), *Zantedeschia Rehmannii* Engl. (1883), *Calla Elliottiana* Knight ex W. Watson (1892), and *Richardia Sprengeri* Comes (1902), have apparently been generally accepted, but the status of two others, *Richardia angustiloba* Schott (1865), and *Zantedeschia macrocarpa* Engl. (1883) has not been definitely settled.

N. E. Brown, in FLORA CAPENSIS (7, pt. I, 6. p. 37. 1897) and in FLORA TROPICAL AFRICA (8, pt. I, p. 169. 1901) reduced *Z. macrocarpa* Engl. to the synonomy of *Z. angustiloba* (Schott) Engl., but Engler (Pflanzner, 4(23 Dc., 65—67. 1915) recognized both species. In the present article, the viewpoint of N. E. Brown is adopted, but it is realized that the subject needs further investigation. *Zantedeschia angustiloba* (Schott) Engl., according to N. E. Brown, is shown in Plate 3, and the typical *Z. macrocarpa* Engl., in Plate 4.

The question apparently is not that of minor intra-specific differences such as size of fruits, but rather if any observed differences are of sufficient importance to warrant specific rank for both on a biologic basis. If the ranges of the two overlap, and the two do not cross in nature, and they thus maintain themselves distinct, then we are certain that they are both entitled to specific rank. If they are separated geographically, then the problem is a more difficult one to solve. The conflict can best be definitely resolved by the consideration of living plants in connection with the herbarium specimens involved, and it is

hoped that Dr. Dyer, or a member of his staff, will give the necessary help toward straightening out this matter.

Unfortunately, the karyology of *Zantedeschia* species has not been investigated, but material has been furnished to Dr. Flory, and the information will be available later.

In America, *Zantedeschia*, the AROID LILY or CALLA LILY, is grown mainly as a greenhouse forcing subject, or as a pot plant, in the North, but it is cultivated out of doors in the South and in California. The importance of the industry is considered by other writers in the present issue of PLANT LIFE.

In the present monograph an attempt has been made to achieve a unified treatise so as to include not only the naturally occurring species, but also hybrids and horticultural selections. In this connection it should be noted that from the standpoint of nomenclature, the International Rules apply to all three categories. It is realized that the Rules concerning cultivated plants have as yet been inadequately drawn up, but that is no reason for delay in applying such Rules as have been agreed upon.

Genus ZANTEDESCHIA Sprengel,

Syst. 3: 765. 1926; Baillon, in Bull. Soc. Linn., Paris, 1: 354. 1888; Engler, Bot. Jahrb. 4: 64. 1883; Engler, in Engl. & Prantl, Nat. Pflanzenfam, ed. 1, 2(3): 136. 1887; Engler, Das Pflanzenr., hft. 64. 1915.

SYN.—*Aroides* Heist., ex Fabricius, Enum. Pl. Hort. Helmst., ed. 2, 2:42. 1763; *(Arodes)* Kuntze, Rev. Gen. 2: 739-740. 1891; Rendle, Cat. Afr. Pl. Welw., 2: 90—91. 1899; *Colocasia* Link, Diss. Bot. Suerin. 77. 1795, et Handb., 1: 267. 1829, non Neck., nec Schott: *Richardia* Kunth, Mem. Mus. Paris, 4: 437, pl. 20. 1818, non Linn.; N. E. Brown, Flora Capensis, 7(Part I): 36—39. 1897; Flora Trop. Afr., 8(Part I): 167—169. 1901: *Otosma* Rafin., Fl. Tellur., 4: 8. 1836, et New Fl. Amer., 2: 90. 1836.

DIAGNOSIS.—Perennial herbs with thick fleshy rhizomes or corms; leaves contemporary with the flowers, all radical with long petioles, and truncate, hastate, saggitate, cordate or lanceolate blades; peduncles solitary, as long as or longer than the leaves; spathe large, showy, white, yellow or rosy, sometimes blotched with purple-brown at base within, persisting and changing to green as the fruit develops; convolute in the lower half, funnel-shaped; limb oblique, open, suberect or recurving, truncate or terminating in a subulate point; spadix monoecious, free, sessile or stipitate, much shorter than the spathe; staminate and pistillate parts contiguous, appendix none; staminodia sometimes mixed with ovaries, other barren organs absent; perigone absent, ovaries 1—6-celled, numerous, crowded, subglobose, stigma discoid, ovules 2—4 in each cell, on axile placentas, anatropous; anthers sessile, crowded, oblong, compressed, truncate at the apex, 2-celled, cells opening by terminal pores; fruit a berry. Type species: *Zantedeschia aethiopica* (Linn.) Sprengel. Eight species, all native to Africa.

Key to the species of the genus **Zantedeschia**

1a. Leaf blades hastate, saggitate, cordate, or oblong-acute with truncate basal lobes:
  2a. Leaf blades hastate, saggitate or cordate:
    3a. Spathe milk white, with or without purple blotch at base inside:
      4a. Leaf blades not white-spotted; bristles on petiole absent; spathe without purple blotch at base inside (Cape Province and Natal) ..... 1. *aethiopica*
      4b. Leaf blades white-spotted; bristles on petiole present or absent; spathe with purple blotch at base inside (Transvaal) ..... 2. *albomaculata*
    3b. Spathe yellow or greenish-yellow, with or without purple blotch at base inside:
      5a. Leaf blades not white spotted:
        6a. Spathe Gamboge-yellow, or intense sulfur colored, with purple blotch at base inside (Transvaal and Angola) ..... 3. *angustiloba*
        6b. Spathe light yellow, tinted greenish, with or without purple blotch at base inside (Basutoland, Transvaal and Natal) ..... 4. *hastata*
      5b. Leaf blades white-spotted, except sometimes without spots in juvenile stage:
        7a. Leaf blades cordate, white-spotted in all stages; spathe bright golden yellow, without purple blotch at base inside (Trop. Transvaal) ..... 5. *Elliottiana*
        7b. Leaf blades hastate-saggitate, or cordate-saggitate, sometimes without spots in juvenile stage; spathe greenish- or lemon-yellow, with purple blotch at base inside, except in var. *concolor* (Natal and Nyasaland) ..... 6. *melanoleuca*
  2b. Leaf blades oblong-acute with truncate basal lobes:
    Leaf blades white-spotted, rarely variegated with white; spathe bright yellow to sulfur yellow, or white or rarely spotted (Transvaal) ..... 7. *Sprengeri*
1b. Leaf blades lanceolate:
  Spathe light rosy-purple, darker but not blotched at base inside, or white or greenish-white to base inside, with rosy tinted margins (Natal) ..... 8. *Rehmannii*

1c. *Zantedeschia* hybrids (see text for names and descriptions.)

1d. *Zantedeschia* forms of unknown origin (See text for names and descriptions.)

1e. Excluded species (See text for names.)

Description of species

1. Zantedeschia aethiopica (Linn.) Sprengel, Syst., 3: 765. 1826. [Plate 1, and Figure 1]

Syn.—*Calla aethiopica* Linn., Sp. Pl., ed. 1, 968. 1753; Bot. Mag. Lond., pl. 832. 1805; *Colocasia aethiopica* Link, Diss. Bot. Suerin. 77. 1795, et Handb. 1: 267. 1795; *Calla ambigua* Salisb., Prodr. 262. 1796; *Richardia africana* Kunth, Mem. Mus. Paris, 4: 433, pl. 20. 1818; N. E. Brown, Flora Capensis, 7: 38—39. 1897; *Richardia aethiopica* (Linn.) Sprengel, Syst., 3: 765. 1826, in synon.; *Otosma aethiopica* Rafin., New Fl. Amer. 2: 90. 1836; et Fl. Tellur. 4: 8. 1036; *Arodes aethiopicum* Kuntze, Rev. Gen. 2: 740. 1891; *Calla generalis* E. H. Krause, Fl. Deutschl. ed. 2, 1: 180. 1906.

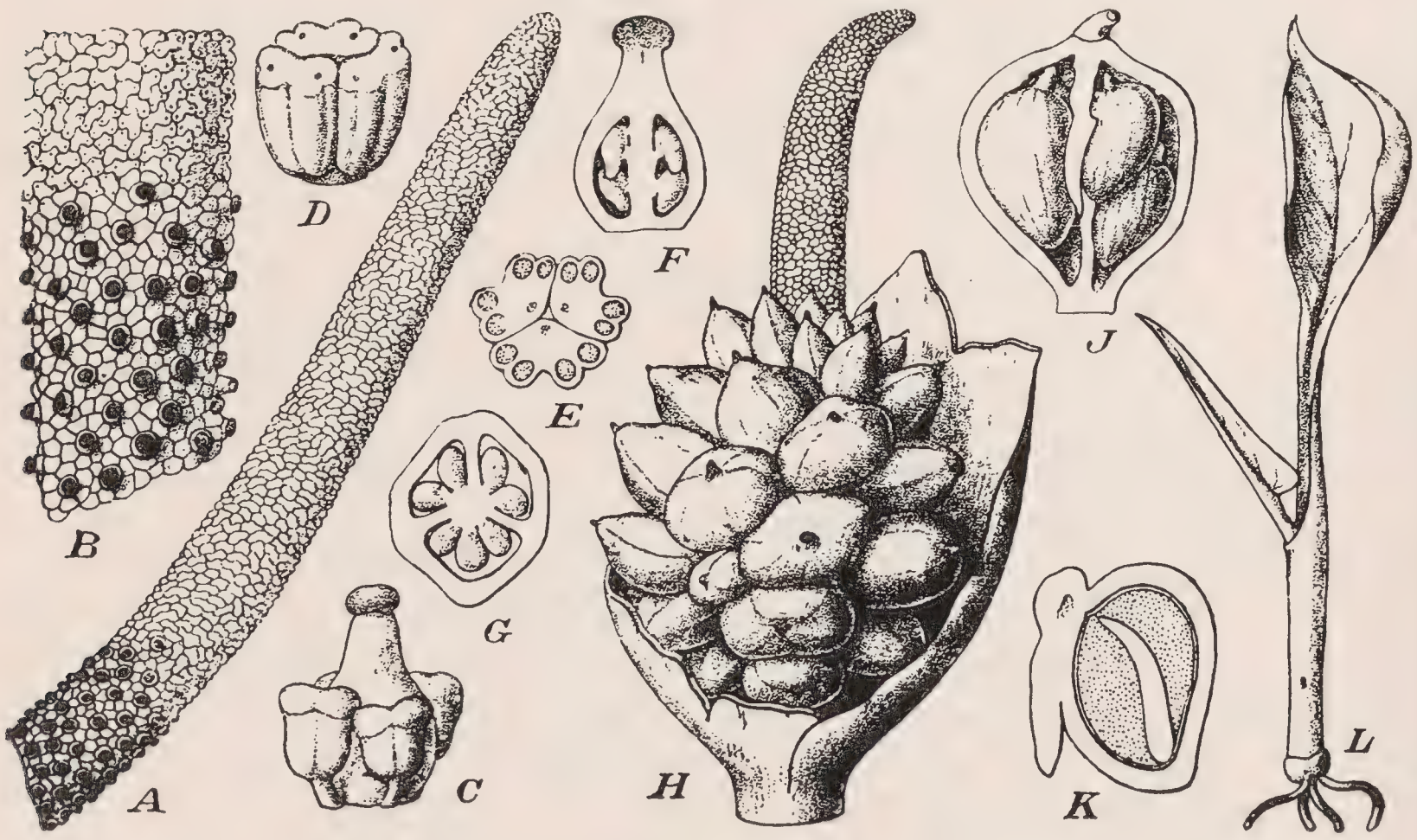


Figure 1. THE IMMACULATE AROID LILY. *Zantedeschia aethiopica* (Linn.) Sprengel. A. spadix .8 nat. size; B. portion of spadix showing staminate and pistillate flowers, 1.6 nat. size; C. pistillate flower with staminodes, 4.8 nat. size; D. staminate flower, 5.6 nat. size; E. same, cross-section, 5.6 nat. size; F. pistil, longi-section, 4.8 nat. size; G. same, cross-section, 6.4 nat. size; H. fruiting spadix, .8 nat. size; J. fruit, 1.6 nat. size; K. seed, 3.2 nat. size; L. seedling plant, .8 nat. size. (Reproduced from Engler, Das Pflanzenr. 4(23Dc): 63. 1915.)

Description.—IMMACULATE AROID LILY. Petiole smooth, without bristles; blade 1.5—4.5 dm. long, 1—2.5 dm. broad, cordate or hastate, obtuse or acute, tipped with a subulate point, the length of the part above the basal lobes much less than twice its breadth, green, unspotted; spathe 1—2.5 dm. long; limb oblique, recurving from the tube, milk white, without any blotch at the base within; spadix sessile, about half as long as the spathe, or less, cylindric; ovaries narrowed into a distinct style 1—2 mm long, pale, greenish-white; staminodia and anthers bright yellow.

RANGE.—South Africa; Cape Province, and Natal.

NOTES.—According to W. Watson (Gard. Chron 12: 123. 1892), this species was "introduced into Europe from South Africa in 1687, when according to Miller, it was sent to Commelyn. Miller cultivated it at Chelsea in 1731." Plate 1, reproduced from Bot. Mag. Lond. pl. 832. 1805, is one of the early illustrations of *Zantedeschia aethiopica* (Linn.) Sprengel.

1a. ZANTEDTSCHIA AETHIOPICA (Linn.) Sprengel var. UMGANIENSIS Leichtlin ex Engler, Pflanzenreich 4 (23 Dc.): 65. 1915.

DESCRIPTION.—Leaf blade ovate-cordate, narrowed from the middle upward, with subulate cusp 2 cm. long, the whole 2.5 dm. long, 1.2 dm. broad, lower lobes semi-ovate, one-third as long as the main portion of the leaf-blade; limb of the spathe broad.

RANGE.—South African highlands; Natal, Howick Falls.

NOTES.—Collected by W. Nelson in 1899.

HORTICULTURAL SELECTIONS. Although most of the horticultural selections of the Immaculate Aroid Lily have been given Latin varietal names, this procedure is not in accordance with the International Rules since these are usually clones that are propagated vegetatively, and have no definite area of distribution in nature. In the present monograph therefore these will be given fancy names to distinguish them from the genuine botanical varieties that exist in nature.

The following list has been compiled from the literature, and is not complete, but should serve as a beginning. It has been possible to obtain in the trade only two of those listed, but it is hoped that this listing will stimulate enthusiasts to search for the remainder so that they may also be offered in the trade in due time.

(a) ZANTEDESCHIA AETHIOPICA c. IMMACULATE GIANT, *nom. nov.;* Syn.— var. GIGANTEA Hort.

DESCR.—Plant very large. The form, PEARL VON STUTTGART may belong here.

(b) ZANTEDESCHIA AETHIOPICA c. SNOW WHITE, *nom. nov.;* Syn.— var. *candidissima* Hort.

DESCR.—Spathe large, pure white.

(c) ZANTEDESCHIA AETHIOPICA c. SWEET PERFUME, *nom. nov.;* Syn.— var. *grandiflora* Harris, Garden & Forest, 5: 587. 1892.

DESCR.—Flowers with particularly "sweet and strong" fragrance.

(d) ZANTEDESCHIA AETHIOPICA c. FRAGRANCE (Burbank, 1899). Syn.— *Calla fragrans* Perry, The Garden, LV: 337. 1899; *Calla* "Fragrance," Burbank ex W. E. Gumbleton, The Garden, LV: 342. 1899.

DESCR.—Plants as large as the type, spathe white, but with "delicious fragrance somewhat resembling that of the *Gardenia* but more delicate."—W. E. Gumbleton.

NOTES.—According to W. E. Gumbleton (1899), this clone "originated in Mr. Burbank's garden in 1894 amongst over 100,000 seedlings of *Calla* LITTLE GEM, but showed no signs of its parentage in the size of its own flowers (spathes) or foliage."

(e) ZANTEDESCHIA AETHIOPICA c. GODFREY. Syn.— var. *Godfreyana* Hort.

DESCR.—Plant medium sized; spathe white.

(g) ZANTEDESCHIA AETHIOPICA c. MIDWAY Hort. ex Len Mirzwick.

DESCR.—Next in size between GODFREY and LITTLE GEM; spathe pure white, spadix yellow; fragrant; blooms from December to June, and is reported as more frost resistant than the other two clones mentioned.

(h) ZANTEDESCHIA AETHIOPICA c. CHILDS PERFECTION, *nom. nov.;* syn.— var. *Childsiana* Hort.

DESCR.—Plant dwarfer and more compact than the type, and more floriferous; spathe white.

(i) ZANTEDESCHIA AETHIOPICA c. LITTLE GEM (T. Sherman, 1890). Syn.—*Richardia aethiopica* var. LITTLE GEM, T. Sherman, Gard. Chron. 1890, p. 755, fig. 153; *Richardia nana compacta* Hort.; *Z.* var. *minor* Engler, in Das Pflanzenr. 63. 1915; *Zantedeschia* c.BABY CALLA Hort.

DESCR.—Differs from the type in being smaller in all its parts, reaching a total height of only 2.3 to 3 dm. with perfectly formed miniature spathes.

NOTES.—First exhibited by Mr. H. Elliott, Springfield Nursery, St. Heliers, Jersey. Sherman (1890) observes, "One great recommendation of this LITTLE GEM for that is its name, is the small space it requires to grow it in, and the small size of the pot, a 32 being the largest size needed."

This clone is grown commercially in California and Florida.

(j) ZANTEDESCHIA AETHIOPICA c. DEVON BEAUTY, *nom. nov.;* Syn.—*Richardia devoniensis* Hort.

DESCR.—Plant dwarf; freer bloomer than LITTLE GEM, and more fragrant.

2. ZANTEDESCHIA ALBOMACULATA (Hook. f.) Baillon, in Bull. Soc. Linn., Paris, 1: 354. 1880; et ex Engl., Bot. Jahrb. 4: 64. 1883. [Plate 2 and Plate 4, E—G]

SYN.—*Richardia albomaculata* Hook. f., Bot. Mag. Lond., pl. 5140. 1859; Lemaire, L'Illus. Hort. 7: pl. 255. 1860; Gartenfl. pl. 462. 1865; Fl. des Serres, 13: 97, pl. 1343; 21: 165, pl. 2258; N. E. Brown, Fl. Capensis, 7: 37—38. 1897.

DESCRIPTION.—Petiole smooth, without bristles; blade 1.5—4.5 dm long, 7.6—23 cm. broad across the basal lobes, hastate or occasionally

Zantedeschia albomaculata (Hook. f.) Baillon

The type illustration, from Bot. Mag. Plate 5140. 1859. See also Plate 4, for Engler's illustrations of the fruiting spadix, the fruit and seed of this species.

Plate 2

sagittate, with a wide open sinus, the part above the basal lobes very elongate-deltoid or elongate-oblong, acute or acuminate, more than twice as long as broad, green, with numerous elongated, semi-transparent, white spots; spathe 6.4—11.4 cm long; limb oblique, suberect, acuminate, milk-white, with a dark purple-brown blotch at the base inside; spadix shortly stipitate, scarcely half as long as the spathe, cylindric; ovaries with a sessile or subsessile stigma, pale greenish; staminodia none, or a few around the uppermost ovaries; anthers yellow; berry 1—5-celled (according to Hooker f.).

RANGE.—Natal, and Transvaal (forma *latifolia* Engl.).

NOTES.—According to Hooker f. (1859) this species was introduced from Natal by Messrs. Backhouse of York, in 1859.

2a. ZANTEDESCHIA ALBOMACULATA forma LATIFOLIA Engler, in Bot. Jahrb., 4: 64. 1883.

DESCRIPTION.—Leaf blades broad-hastate, lower lobes spreading, gradually narrowing toward the upper end.

RANGE.—Transvaal.

NOTES.—This is hardly worthy of listing separately since there is only a difference in the leaf blade.

3. ZANTEDESCHIA ANGUSTILOBA (Schott) Engl., Bot. Jahrb., 4: 64. 1883. [Plate 3 and Plate 4, H—N]

SYN.—*Richardia angustiloba* Schott, in Jour. Bot. 3: 35. 1865; N. E. Brown, Flora Capensis, 7 (Part I): 37. 1897; Flora Trop. Afr., 8 (Part I): 169. 1901; *Zantedeschia macrocarpa* Engl., Bot. Jahrb. 4: 64. 1883; Pflanzenr. 4 (23 Dc.): 67, fig. 30, H—M, incl. 1915; *Richardia macrocarpa* W. Watson, Gard. Chron. 124. 1892; *Richardia Pentlandii* Whyte ex W. Watson, Gard. Chron. 123. 1892, et 590. 1894; et ex Hook. f. Bot. Mag. t. 7397. 1895; Whyte, The Garden, 1895; Rev. Hort. 67: 37-38. 1895; *Aroides angustilobum* Rendle, in Cat. Afr. Pl. Welw. 2: 90-91. 1899; *Arodes angustilobum* O. Kuntze, Rev. Gen. Pl. 2: 740. 1891; *Zantedeschia chloroleuca* Engl. et Gilg, in Warburg, Kuene-Sambesi Exped. 180. 1903.

DESCRIPTION.—Leaves glaborous; petiole smooth, without bristles; blade 1.9—4.3 dm. long, 1—2.8 dm. broad across the basal lobes, hastate, green without spots; the part above the basal lobes elongate-deltoid or elongate-oblong, often very narrow, acute or acuminate, 2—5 times as long as broad; basal lobes very variable, short or long, sometimes very spreading, sinus very open; peduncle about as long as the leaves, smooth; spathe 1—1.1 dm. long, clear deep gamboge-yellow, with a purple-brown blotch at the base inside, according to Welwitsch "intense sulphur-colored, blood-red at the base inside," paler outside; tube funnel-shaped; limb oblique, subhorizontal, acute; spadix shortly stipitate, scarcely half as long as the spathe, cylindric, obtuse; ovary subglobose, pale greenish-white; style short; stigma small, discoid; staminodes none; anthers yellow; berries large, subglobose or obovoid.

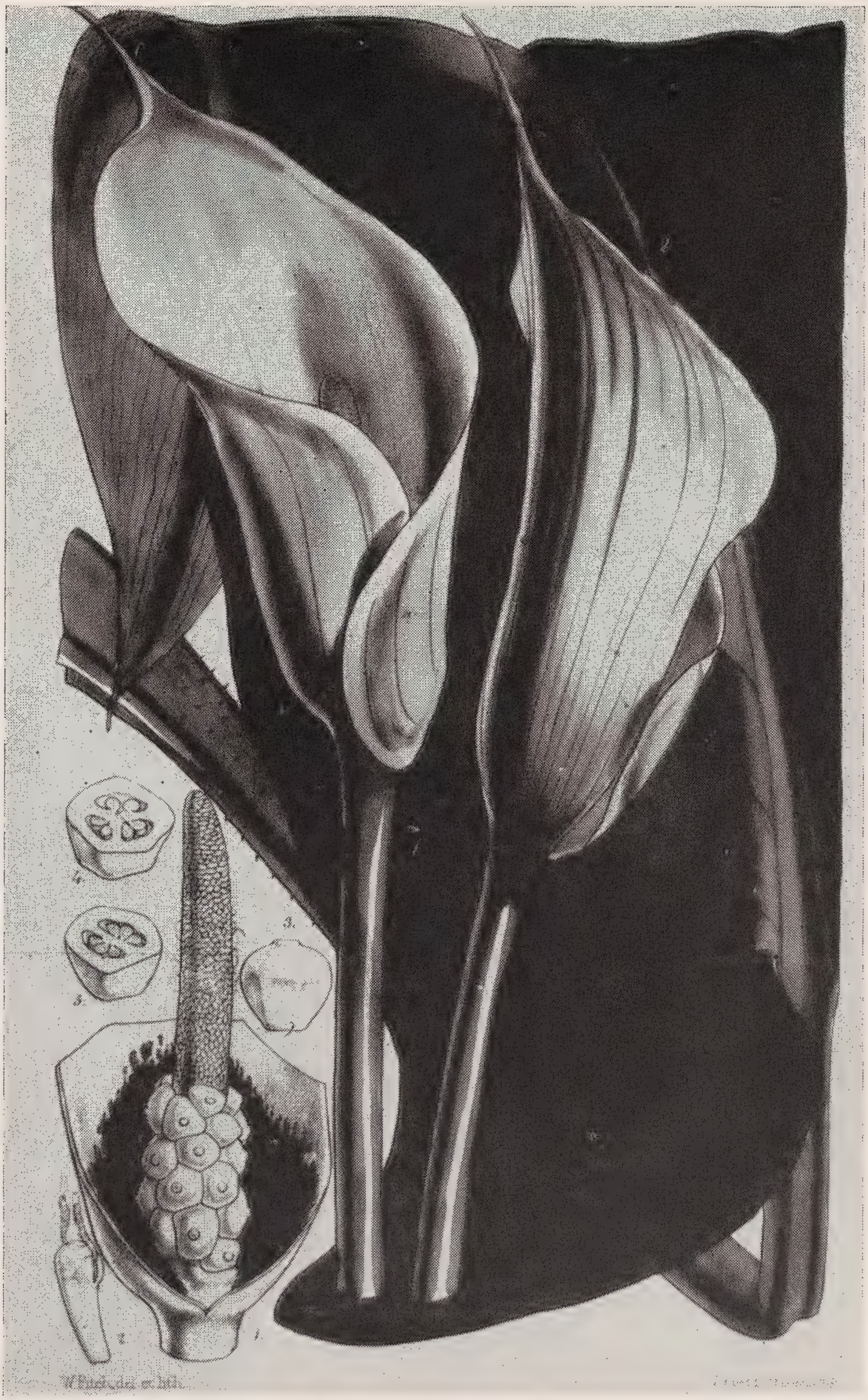
Zantedeschia angustiloba (Schott) Engl.

The first illustration of this species (syn.—*Richardia Pentlandii* Whyte ex W. Watson), reproduced from Bot. Mag. Lond., Plate 7397. 1895. See also Plate 4, for *Z. macrocarpa* Engl., reduced to synonomy of *Z. angustiloba* by N. E. Brown.

Plate 3

A—D, *Zantedeschia Rehmannii* Engl., A, flowering plant, .3 nat. size; B, spadix, .8 nat. size; C, single-celled pistil, longi-section, 1.2 nat. size; D, 2-celled pistil, longi-section, 1.2 nat. size. E—G, *Z. albomaculata* (Hook. f.) Engl., E, fruiting spadix, .8 nat. size; F, fruit with staminodes, 1.5 nat. size; G, seed, .5 nat. size.— H—N, *Z. macrocarpa* Engl., H, flowering plant, .16 nat. size; J, lower part of spathe, and spadix, .8 nat. size; K, stamen, .6 nat. size; L, pistil, .6 nat. size; M, fruit, upper view, .8 nat. size; N, same, longi-section, .8 nat. size. (Reproduced from Engler, Das Pflanzenr. 4(23Dc): 66. 1915.)

Plate 4



Zantedeschia hastata (Hook. f.) Engl.

The type illustration, reproduced from Bot. Mag. Lond., Plate 5176. 1860.

Plate 5

RANGE.—Transvaal and Angola.

NOTES.—According to E. Hill (The Garden, 55: 317, 319. 1899), in the Tring Park variety (of *Richardia Pentlandii* = *Zantedeschia angustiloba)* "the color of the spathe is gold almost to an orange shade, yet very pure and uniform throughout the entire set of plants shown. There are also the same characteristic blotch within and the translucent blotches on the leaves. The latter, however, are of unusual size."

4. ZANTEDESCHIA HASTATA (Hook. f.) Engl., Bot. Jahrb. 4: 64. 1883. [Plate 5]

SYN.—*Calla? oculata* Lindley, in Gard. Chron. 1859, p. 788, nom. prov.; *Richardia hastata* Hook. f., Bot. Mag. Lond., pl. 5176. 1860; N. E. Brown, Flora Capensis, 7 (Part I): 38. 1897; Flora Trop. Afr. 8 (Part I): 168—169. 1901; *Arodes hastatum* O. Kuntze, Rev. Gen. Pl. 2: 270. 1891; *Aroides hastatum* Rendle, in Cat. Afr. Pl. Welw. 2: 90—91. 1899. *Richardia Lutwychei* N. E. Brown, Gard. Chron. 13: 568. 1893; (errore *R. Lutwichei)* Hort. ex Rev. Hort. lxxiii: 249. 1895; *Zantedeschia Lutwychei* Durand & Schinz, Consp. Fl. Afr. 5: 477. 1895; *Zantedeschia oculata* Engl. Pflanzenr. Arac., etc., 68. 1915; *Zantedeschia oculata* (Lindl.) Burtt Davy, Kew Bull. Misc. Inf. 234. 1924.

DESCRIPTION—Leaves with petioles 3—4.5 dm. long, having soft bristle-like hairs on the lower part, which wither and often disappear in the dried state; blade green, without spots, 2.2—3.4 dm. long, 1—1.9 dm. broad across the basal lobes, triangular-sagittate or hastate, acute, the part above the basal lobes usually less than twice as long as broad; basal lobes very broadly ovate or rounded, very obtuse, overlapping one another at the sinus, or spreading; peduncle about 3 dm. long, smooth; spathe 7.6—10 cm. long, light yellow, tinted with green outside, marked with a large purple-brown blotch at the base inside; tube funnel-shaped, limb obliquely truncate at the mouth, abruptly subulate-pointed; spadix about half as long as the spathe, cylindric, obtuse; ovary augular-globose, light green; style very short, conical; stigma small; staminodes none; anthers yellow.

RANGE.—South Africa, Basutoland, Transvaal and Natal.

NOTES.—N. E. Brown (Flora Trop. Afr. 8: 169. 1902) states, "The difference of the overlapping basal lobes of the leaf, and the presence of bristles on the petiole, by which I originally distinguished *R. Lutwychei* from *R. hastata,* I find to be inconstant; with regard to the bristles on the petiole of *R. hastata* they are either sometimes absent, or disappear in the process of drying."

Lindley (1859) first described this species under the provisional name "*Calla? oculata*" from specimens received by Messrs. Veitch & Co., from Natal in 1857.

5. ZANTEDESCHIA ELLIOTTIANA (Knight ex Watson) Engler, in Engl. Pflanzenr., Arac.—Anuiod., etc., 18. 1915; Burtt Davy, Kew Bull., Misc. Inf., 234. 1924. [Plate 6]

SYN.—*Calla Elliottiana* Knight ex W. Watson, Gard. Chron. 12: 123. 1892; Garden & Forest, 5: 330. 1892; *Richardia Elliottiana* (Knight

Zantedeschia Elliottiana (Knight ex W. Watson) Engl.

THE GOLDEN AROID LILY. The first illustration of this species, reproduced from Rev. Hort. Belg. 23: Plate facing page 13. 1897.

Plate 6

ex W. Watson) Mottet, Rev. Hort. 67: 38. 1895; E. de Duren, Rev. Hort. Belg. 23: 13 cum tab. 1897; Hook. f., Bot. Mag. Lond., pl. 7577. 1898; N. E. Brown, Flora Trop. Afr. 8: 167—168. 1901; *Richardia Rossii* Chalwin, Gard. Chron. 21: 259. 1897, et 21: 58, 243. 1897.

DESCRIPTION.—GOLDEN AROID LILY. Leaves glabrous; petiole 3 dm. or more long, smooth, without bristles; blade bright green, marked with numerous transparent white elongated spots, 2.3—2.8 dm. long, 1.5—2.5 dm. broad, ovate or orbicular-ovate, obtuse, with a subulate point at apex, cordate at base; basal lobes very broadly rounded; sinus about 5 cm. deep; peduncle longer than the leaves, smooth, green; spathe 1.3—1.5 dm. long, bright golden-yellow, without a purple blotch at the base within; tube funnel-shaped; limb oblique, subhorizontally spreading, obtuse, with a subulate point; spadix about half as long as the spathe, cylindric, obtuse; ovaries subglobose, angular from mutual pressure, pale-greenish; stigma sessile, discoid; staminodes none; anthers orange-yellow; berries large, about 1.9 cm. in diam., obovoid or subglobose, green.

RANGE.—Tropical Transvaal.

NOTES.—According to W. Watson (1892), this species was named in honor of Capt. Elliott, of Farnboro Park, Hampshire.

According to Burtt Davy (1924), *Zantedeschia Elliottiana* "differs from *Z. angustiloba*, the other golden-spotted species, in its much larger size, broad spotted leaves more deeply cordate at the base, the smooth surface of the limb of the spathe within, and the absence of purple coloring at its base; also in the large ovaries and sessile stigma."

The proposed species, *Richardia Rossii* Chalwin—incompletely described in Gard. Chron. 21: 58. 1897,—"plants with broad leaves set on rather short petioles, regularly spotted over the entire surface of the blade. Spathes as high or higher than the leaves"—apparently is not even a distinctive variety of *R. Elliottiana* but may be a free-flowering form of it with spathes of "brightest shade of yellow" as indicated by Donald Ross. The W. L. Lewis Co., (Gard. Chron. 21: 259. 1897) indicated that it would "put this matter straight within a few months, when the plants will be blooming [in England]," but examination of the indices of vols. 22, 23 and 24 did not reveal any further reports. It is assumed that the W. L. Lewis Co., itself was convinced that *R. Rossii* is synonymous with *Z. Elliottiana.*

6. ZANTEDESCHIA MELANOLEUCA (Hook. f.) Engl., Bot. Jahrb. 4:64. 1883. [Plate 7]

SYN.—*Richardia melanoleuca* Hook. f., Bot. Mag. Lond., pl. 5765. 1869; N. E. Brown, Flora Capensis, 7: 38. 1897.

DESCRIPTION.—NATAL AROID LILY. Petiole with soft bristles on the lower part; blade 1.3—2 dm. long, 6.4—15 cm. broad across the basal lobes, deltoid or ovate-deltoid, acute, with a subulate point, hastate or sagittate at the base, with an open sinus, the part above the basal lobes usually much less than twice as long as broad, green, with numerous semi-transparent white spots; spathe 5—7.6 cm. long, obliquely subtrun-

Zantedeschia melanoleuca (Hook. f.) Engl.

The type illustration, reproduced from Bot. Mag. Lond., Plate 5765. 1869.

Plate 7

cate at the mouth, light yellow or greenish-yellow, with a dark purple-brown blotch at the base inside; spadix shortly stipitate, cylindric; ovaries with scarcely any style, pale greenish; stigma subsessile; staminodia none; anthers yellow. (Note also two varieties below—*tropicalis* and *concolor.)*

RANGE.—Natal.

NOTES—According to Hooker. f. (1869) this species was "imported by Mr. Bull, of Chelsea, from Africa, and was flowered in his establishment in the autumn of 1868."

6a. **Zantedeschia melanoleuca** (Hook. f.) Engl., **var. tropicalis** (N. E. Brown) Traub **comb. nov.**

SYN.—*Richardia melanoleuca* Hook. f., var. *tropicalis* N. E. Brown, Flora Trop. Afr. 8: 168. 1901.

DESCRIPTION.—Leaves glabrous; petiole 2.3—8.6 dm. long, smooth, without the soft bristles at the base that are characteristic of the type; blade 2—3.6 dm. long, 1.2—3.5 dm. broad across the basal lobes, hastate or somewhat sagittate in the smaller leaves, acute, green, marked with transparent white linear spots; basal lobes spreading, obtuse; peduncle longer than the leaves, smooth; spathe 7.6—14 cm. long, lemon-yellow, with a crimson blotch at the base inside; tube funnel-shaped; limb oblique, tapering into a subulate point; spadix shortly stipitate, not half as long as the spathe, cylindric, obtuse; ovary subglobose, green; style .7—1 mm. long; stigma small; staminodes none, or confined to a very few of the uppermost female flowers.

RANGE.—Nyassaland.

NOTES.—According to N. E. Brown (1901) "In the young state the leaves of this variety are elongate-ovate, acute, cordate-sagittate at the base, and green without any spots, the spots developing with the age of the plant." He also states that "This differs from the typical South African form by its larger size, and by the absence of the soft bristles at the base of the petioles so characteristic of the Natal plant. The stigma is not always subsessile in the typical *melanoleuca* Hook. f., as I had previously described, some specimens having a distinct style about .6 mm. long."

6b. ZANTEDESCHIA MELANOLEUCA (Hook. f.) Engl., var. CONCOLOR Burtt Davy, Kew Bull. Misc. Inf., 233. 1924.

DESCRIPTION.—Differs from the type in having fewer, smaller and more irregular white spots on the leaf-blades, and in the absence of the purple blotch at the base inside the spathe.

RANGE.—South Africa.

NOTES.—According to Burtt Davy (1924) this is apparently not a hybrid, since van Tubergen reports that it reproduces true from seeds, and is deciduous, losing its leaves in autumn.

7. ZANTEDESCHIA SPRENGERI (Comes) Burtt Davy, Kew Bull. Misc. Inf. 234. 1924.

SYN.—*Richardia Sprengeri* Comes, in Atti Inst. Incorazz., Napoli, ser. 5, vol. 3, no. 7, pl. col., 1902; fide Terracciano, in Bot. Centralbl. 89: 660. 1902; N. E. Brown, Gard. Chron., 31: 349. 1901; 32: 350. 1902.

DESCRIPTION.—TRANSVAAL AROID LILY. Petiole 1.5—1.8 dm. long, smooth, without bristles at the base; blade 2—2.3 dm. long, 7.5—8.5 cm. broad, oblong, acute at the apex, truncate (not hastate nor cordate) at the base, green, marked with semi-transparent white spots, and sometimes varigated as well with white; peduncle 3—3.5 dm. tall, smooth, glabrous; spathe broadly funnel-shaped, bright clear yellow, varying to sulphur-yellow or white, or sometimes spotted; when flattened out measuring 1—1.1 dm. long, exclusive of the 1.2—1.8 cm. long subulate cusp, and 12.5—13 cm. in breadth, somewhat transversely rhomboid-ovate or rhomboid-orbicular in outline; spadix shortly stipitate, not half as long as the spathe; ovaries without neuter organs mingled with them, somewhat 4-angled, with sinuous sides as viewed from above, flattened at top; stigma sessile.

RANGE.—Transvaal.

NOTES.—Named for Carl Sprenger of Naples, who imported it in 1898. Burtt Davy (1924) observes, "It is one of the yellow-flowered group, 'rivaling *R. Pentlandii* and *R. Elliottiana*' in color, and has equally large if not larger spathes, differing from these and all other species in the form of the leaves and the broader, funnel-shaped, or somewhat trumpet-mouthed spathes, which when flattened out, are broader than those of any other species."

The Italian periodical "ATTI INST. INCORAZZ., NAPOLI," is not available in America, and it was therefore not possible to include a reproduction of the plate showing *Z. Sprengeri* that appeared in that publication in 1902. It is hoped that our Italian friends will furnish a set of this rare periodical for one of the research libraries in America so that it will be available for microfilm copying.

8. ZANTEDESCHIA REHMANNII Engler, Bot. Jahrb. 4: 63. 1883; *Z. Stehmannii*, (sphalm.) Sprenger, Wien., Ill. Gart. Zeit. 415. 1901. [Plate 4, A—D, and Figure 2]

SYN.—*Richardia Rehmannii* (Engler) W. Harrow ex N. E. Brown, in Gard. Chron. 14: 659. 1893; N. E. Brown, Flora Capensis, 7: 36—37. 1897; *R. Lehmannii* (sphalm.), N. E. Brown ex E. H. Krelage, Gard. Chron. 14: 564, fig. 94. 1893; *R. Rehmannii* (Anon.), Gard. Chron. 14: 658. 1893; (Anon.), Gard. Chron. 14: 770. 1893; E. H. Krelage, Gartenfl. 43: 12—14, abt. 7, p. 15. 1894; Mottet, Rev. Hort. 67: 38. 1895; *Richardia Rehmanniana* (sphalm.), Hook. f., Bot. Mag. Lond., sub pl. 7397. 1896; *Richardia Stehmannii* (sphalm.), Sprenger, Wien., Ill. Gart. Zeit. 415. 1901; *Richardia nilotica* W. Watson, Garden & Forest, 5: 618. 1892; Flora Trop. Afr. 8: 169. 1902.

DESCRIPTION.—RED AROID LILY. Petiole smooth, without bristles; blade of the leaf 1.9—3.8 dm. long, 2.5—5 cm. broad, lanceolate, acuminate, subulate at the apex, cuneate at the base, of an uniform green, or marked with short, linear, semi-transparent white spots; spathe

7.6—11.3 cm. long; limb oblique, more or less recurved, light rosy-purple, darker but not blotched at base within, or white or greenish-white to the base within, with rosy-tinted margins; spadix not half as long as the spathe, stipitate, cylindric; ovaries with very short, stout styles; anthers yellow; fruits obovoid or depresso-obtuse, 1-2-loculate, 6 mm. long, 5-8 mm. thick, locules 1-seeded; seeds about 5 mm. long.

RANGE.—Natal, dry or stony hills.

NOTES.—This species was named for Rehmann, German missionary and plant collector in the Transvaal from 1875 to 1888. The type description was based on specimens that included the leaves and mature inflorescence with fruits. Engler indicated that the leaves were lanceolate and the fruits 1- or 2-celled with one seed per cell. On the basis of the latter character particularly he suggested the provisional subgenus *Oligosperma* to accommodate the species. His suggestion was not apparently acceptable.

Bailey (Stand. Cyclo. Hort. 3: 3536. 1939) lists "forma *speciosa*" which is described as dwarfer and more robust than the type.

HORTICULTURAL SELECTIONS. The following is an incomplete listing of cultivated selections of *Z. Rehmannii*.

(a) ZANTEDESCHIA REHMANNII c. CALIFORNIA PINK, *nom. nov.*

SYN.—"Dark rose pink variety," Houdyshel, Bulbs for Pots (Catalog), Fall, 1947. La Verne, Calif., 1947, p. 27.

DESCR.—Spathe dark rose pink.

(b) ZANTEDESCHIA REHMANNII c. CARMINE QUEEN, *nom. nov.*

SYN.—*Richardia Rehmannii* var. *carminea*, van Tubergen, Autumn 1946—Spring 1947 Cat., 1946, p. 24.

DESCR.—Spathe carmine red.

(c) ZANTEDESCHIA REHMANNII c. PINK LADY, *nom. nov.*

SYN.—*Zantedeschia Rehmannii* var. *elegans* Hort., in Houdyshel, Bulbs for Pots (Catalog). Fall, 1946, La Verne, Calif., p. 31.

DESCR.—Light pink spathes "of a lovely shade that many like better than the darker colored type. It is a taller and better grower, is easier to force in pots, but when forced many report that the flowers are white. Even in the gardens some flowers are white with shell pink tintings. But the white ones are still lovely, more so than the white *aethiopica*."

(d) ZANTEDESCHIA REHMANNII c. STRAWBERRY RED Mirzwick.

DESCR.—Plant larger than in the type, up to 6 dm. tall; leaves more numerous per single corm which produces from 4 to 6 flowers; spathe dark strawberry red in color.

NOTES.—This clone was apparently introduced by Len Mirzwick.

(e) ZANTEDESCHIA REHMANNII c. AUSTRALIAN BEAUTY, *nom. nov.*, Montague, Cat. 2nd Sp. ed., p. 53.

DESCR.—Larger and deeper colored than the type.

(f) ZANTEDESCHIA REHMANNII c. VIOLET QUEEN, *nom. nov.*, Montague, Cat. 2nd Sp. ed., p. 53.

DESCR.—Violet red shade.

Figure 2. THE RED AROID LILY. *Zantedeschia Rehmannii* Engl. The first illustration of this species; reproduced from Gardeners' Chronicle, 14: Fig. 94. 1893. See also Plate 4, for Engler's later illustration, and morphological details.

Zantedeschia Hybrids and Forms of Unknown Origin

This section is devoted to the available information on (a) artificial hybrids between various *Zantedeschia* species, and (b) various forms of unknown origin. No claim is made for an exhaustive treatment, but the information available to the writer is briefly summarized.

The nomenclature used is in conformity with the International Rules. For each combination of species, representing reciprocal crosses, a single binomial, the first one validly published, is recognized (Art. 31), and any selected cultivated forms are given fancy epithets (names) under this binomial (Art. 34).

Examples:

(1) Hybrids (unselected): *Z. melanoleuca* x *Z. Rehmannii* = *xZantedeschia cantabrigiensis* Lynch ex Engler
Hybrids (selected): *xZantedeschia cantabrigiensis* c. MRS. ROOSEVELT *xZantedeschia* c. SOLFATARE

(2) Forms of unknown origin: *Zantedeschia Nelsonii* Smith & Bailey *Zantedeschia* c. NEW CREAM Hort. ex Mirzwick

It should be noted that there are no reported hybrids between *Z. aethiopica,* with a ramifying rootstock and not requiring a complete resting period, and the rest of the species of the genus, with compact corms and requiring a complete resting period. The writer has attempted such crosses. Although seeds developed they did not germinate and eventually rotted. The attempts however are being continued. There may be a distinct gap from the standpoint of gene exchange. It will be of interest to hear from other breeders. Crosses within the compact form group apparently can be readily made as shown by the reported results, which have been verified by the writer.

(A.) **Z. albomoculata x hastata**

(a) **xZantedeschia aurata** (Deleuil ex W. Watson) Traub, **comb. nov.**

SYN.—*Richardia aurata* Deleuil ex W. Watson, Garden & Forest, 5: 617—618. 1892; Rev. Hort. p. 27. 1893; Mottet, Rev. Hort. 67: 38. 1895 (err. *R. curata*); Weathers, Bulb Book, 406—407. 1911.

DESCR.—*xZ. albomaculata* x *hastata;* plant 6 dm. tall, with white-spotted, hastate leaf blades, and well developed spathes of a beautiful chrome-yellow color.

NOTES.—According to W. Watson (1892), this hybrid was produced by J. B. M. Deleuil, Marseilles, France.

(B.) **Z. albomaculata x Elliottiana**

(a) xZANTEDESCHIA LATHAMIANA Hort., ex Smith & Bailey, Stand. Cyclo. Hort. 1939; et R. Irwin Lynch, Gard. Chron. 35: 226. 1904.

DESCR.—*xZ. albomaculata* x *Elliottiana;* no description available.

NOTES.—Reported without a name by R. Irwin Lynch (1904) as flowering for the first time in 1903 for Mr. W. B. Latham, then of the Birmingham Botanic Garden; the name *Zantedeschia Lathamiana* apparently was given by Smith & Bailey, but without a description.

(C.) Z. [Z.albomaculata x hastata] x Z. Elliottiana

(a) xZantedeschia Taylori (Lynch) Traub, comb. nov.

Syn.—*Richardia Taylori* Lynch, in Gard. Chron. 35: 226. 1904; Bailey, Stand. Cyclo. Hort. 1939.

Descr.—*xZ. aurata* x *Z. Elliottiana;* no description available.

Notes.—According to Lynch (1904), this hybrid was first raised by Messrs. Clibran & Sons.

(D.) Z. melanoleuca x Rehmannii

(a) xZantedeschia cantabrigiensis Lynch ex Engler, Lynch, in Gard. Chron. 35: 226. 1904; et Engler, Pflanzenr. 4(23 Dc.): 69. 1915.

Syn.—*Richardia cantabrigiensis* R. Irwin Lynch, in Gard. Chron. 35: 226. 1904.

Descr.—*CAMBRIDGE AROID LILY.* Reciprocal crosses: *Z. melanoleuca* x *Rehmannii;* Leaves intermediate between *Z. melanoleuca* (type) and *Z. Rehmannii* (type), and with little or nothing of the hispidity of *Z. melanoleuca;* spathe half open, ivory white flushed with pink; slightly pink on the inside, but deeper on the outside, with a splendid dark blotch at the base inside.

Notes.—These reciprocal crosses which were made by R. Irwin Lynch (1904), of the Cambridge Botanic Garden, England, "appear to be identical, and besides having an elegant shape, conferred by *R. melanoleuca*, appear to possess an important point of interest in the fact that the slight tendency (in England) of the spathe in *Rehmannii* to be pink is greatly intensified. This species has been called the pink *Richardia,* but an African sun is apparently necessary to bring out the color; while in these hybrids, under conditions which induce no trace of colour in *R. Rehmannii*, the pink colour is very clearly in evidence, slight perhaps on the inside of the spathe, but more deeply on the outside. It may be said that they are ivory-white flushed with pink. . . . As in *R. melanoleuca*, these hybrids have a splendid dark "eye," and in this particular they are governed by that parent, whichever way the cross is made, *R. Rehmannii* having no trace of it. The leaves in outline and general character are nearly intermediate; and stalks are colored much as in *R. melanoleuca*, but have little or nothing of the hispidity characteristic of that species. Small Richardias, especially those, I think, with half open spathe like *R. melanoleuca* and these hybrids, are especially good for cutting. One of these hybrids and the parent made, with slight additions, an exceedingly elegant arrangement in a silver vase in the Queen's Room at the Fitzwilliam Museum on the occasion of the recent Royal visit to Cambridge, when the new schools and other buildings were opened by the King. . . . An object in crossing Richardias should be to obtain a free-flowering habit in combination with the brilliant qualities in color of such fine plants as *R. Pentlandii.*"

(b) xZANTEDESCHIA CANTABRIGIENSIS c. MRS. ROOSEVELT. Gard. Chron. ex Engler, Pflanzenr. 4: (23 Dc.): 69. 1915.

DESCR.—Cross: *Z. melanoleuca* x *Rehmannii* forma *violacea;* leaf blade somewhat spotted in the middle; spathe tinged with violet above the violet base.

(E.) **Z. Elliottiana x Rehmannii**

(a) **xZantedeschia Ragionieri** Traub, **nom. nov.**

SYN.—*xR. Elliottiana* x *R. Rehmannii,* Bois, in Rev. Hort. 9: 349. 1909; *xZ. Elliottiana* x *Z. Rehmannii,* Engler, Pflanzenr. 4(23 Dc.): 69. 1915.

DESCR.—RAGIONIERI AROID LILY. Cross: *Z. Elliottiana* x *Rehmannii;* no description of the progeny available except for the selected horticultural form described below.

NOTES.—These hybrids were made by the late Dr. A. Ragionieri at Firenze, Italy.

(b) **xZantedeschia Ragionieri** c. **Madame Fosca Ragionieri,** Traub, **comb. nov.**

SYN.—*Richardia* MADAME FOSCA RAGIONIERI, Bois, in Rev. Hort. 9: 349. 1909; Engler, Pflanzenr. 4(23 Dc.): 69. 1915.

DESCR.—Leaf blade blackish-green, marked by elongate white spots, subtriangular, 4.5 dm. long, 2 dm. broad, thick-ribbed; immature spathe pinkish-violaceous, when mature, 12 cm. long, 6 cm. broad, the lower third of trumpet greenish, white above the blade, veins tinged with pinkish-violet, pale tawny within, slightly tinged with pinkish-violet on the margin. Differs from typical Zantedeschias in that the spathe is emarginate below the upper third and so is three-lobed.

NOTES.—This is a named selection of *xZantedeschia Regionieri.*

(F.) **Zantedeschia** Hybrids of Unknown Parentage

(a) xZANTEDESCHIA c. SOLFATARE (van Tubergen) Traub, *comb. nov.*

SYN.—*Richardia* c. SOLFATARE C. G. van Tubergen, Autumn 1946—Spring 1947 Cat., 1946, p. 24; Montague, Cat. 2nd Sp. ed., p. 53.

DESCR.—Hybrid, origin not indicated; spathe large, sulfur yellow.

(b) xZANTEDESCHIA c. CYNTHIA (van Tubergen) Traub, *nom. nov.*

SYN.—*Richardia pallida* C. G. van Tubergen, Autumn 1946—Spring 1947, Cat. 1946, p. 24.

DESCR.—Hybrid, origin not indicated; spathe large, pale yellow with violet central blotch.

(G.) **Zantedeschia** Forms of Unknown Origin

(a) RICHARDIA INTERMEDIA Hort., Smith & Bailey, Stand. Cyclo. Hort. 3; 1939.

Syn.—Very free flowering; leaf stalks bright green, marbled with white and rose; spathe very dark yellow, with small black blotch at the base.

(b) Richardia Adlamii Hort., Leichtlin ex Bailey, Cyclo. Hort. 3: 3536. 1939.

Descr.—Strong-growing, with leaves saggitate, bright green, and somewhat exceeding the scape; spathe short and rather open, creamy white with a black or purple throat. Trop. Afr.?

Notes.—According to Bailey (1939) this was distributed by Max Leichtlin (Germany) in 1898, and that there are hybrids of this and *Z. Elliottiana.*

(c) Richardia suffusa E. Hill, The Garden 55: 317. 1899.

Descr.—A distinct dwarf-habited plant with a creamy-white spathe, the base in the inside of a rich violet-purple shade. It is apparently a plant of good constitution. From Lord Rothschild, Twing Park; gardener, Mr. E. Hill.

(d) Zantedeschia Nelsonii Smith ex Bailey, in Stand. Cyclo. Hort., 6:3536. 1939.

Syn.—*Richardia Nelsonii* J. G. Smith, Cyclo. Amer. Hort. p. 1534; Montague, Cat. 2nd Sp. ed., p. 53.

Descr.—Allied to *Z. albomaculata;* very vigorous and floriferous, reaching 9—12 dm., in height; scape overtopping the foliage; leaves saggitate, bright green, sprinkled with pellucid dots or spots, as in *Z. Elliottiana;* spathe scarcely spreading, the limb short, very pale yellow, with a purple blotch at the bottom.

Range.—Unknown.

Notes.—In southern California, according to Bailey (1939), this species blooms only in summer, after *Z. Elliottiana* is past. Mirzwick, in the present issue of Plant Life, indicates the flowering season as from May to July.

This may be a variety of *Z. albomaculata,* but the subject needs further study before a definite disposition can be made.

(e) Zantedeschia c. New Cream Hort. ex Mirzwick.

Descr.—Plant robust in growth; blooms from June to July; spathe rich cream color, with slight dark blotch in throat.

Notes.—Mirzwick considers this a sport of *Z. albomaculata.*

(f) Zantedeschia c.Lemon Cream Hort. ex Mirzwick.

Descr.—Plant robust, leaves arrow-shaped, sprinkled with pellucid dots throughout; spathe large, widely flaring, and tip recurved, soft lemon yellow in color, and with slight dark blotch inside at base; flowering season from June to August.

Notes.—Mirzwick does not indicate the origin of this plant.

(g) ZANTEDESCHIA c. PURPLE HEART Hort. ex Farmer Seed & Nursery Co., Cat. Faribault, Minn., p. 42. 1948.

DESCR. —Leaves deep green, with white translucent spots; spathe pale creamy-yellow, with intense purple blotch in the throat.

NOTES.—Origin not indicated.

(h) ZANTEDESCHIA c. ALDA MI, Montague, Cat. 2nd Sp. ed., p. 53.

DESCR.—Cream with large violet blotch in throat.

(i) ZANTEDESCHIA c. CHROMATELLA, Montague, Cat. 2nd. Sp. ed., p. 53.

DESCR.—Yellow, with large violet blotch in throat.

(j) ZANTEDESCHIA c. GOLDEN GLORY, Montague, Cat. 2nd Sp. ed., p. 53.

DESCR.—Deep golden yellow, with black velvety blotch in throat.

EXCLUDED SPECIES

Calla occulta Lour., Fl. Cochinch., 2: 532. = *Homalomena aromatica.*

Zantedeschia aromatica Sprengel, Syst., 3: 765. = *Homalomena aromatica*

Zantedeschia asperata C. Koch, in Ind. Sem. Hort. Berol. 1853, App. 5. = *Philodendron asperatum.*

Zantedeschia occulta Sprengel, Syst., 3: 765. = *Homalomena aromatica.*

[GENUS ZANTEDESCHIA— INDEX TO GENERA AND SPECIES— turn to page 47.]

ZANTEDESCHIAS FROM FRENCH EQUATORIAL AFRICA

A. A. LONGMIRE, *California*

Recently the writer has received from Africa the rare PRIDE OF THE CONGO, *Zantedeschia hastata* (Hook. f.) Engl. (syn.— *Z. oculata* (Lindl.) Engl.), which he has attempted to obtain for many years. The corms came to him from Bongolo Mouila Gabon, French Equatorial Africa from a location inhabited by a pygmy tribe of negroes, and were sent by a missionary who had spent 20 years along the Congo River with these people.

The package received contained three species, perhaps all belonging to the genus *Zantedeschia*, and was three months in transit. On arrival the corms had started into growth. They were placed in large pots, using a sand-gravel mixture as a potting medium. To insure against loss, the plants will be grown under glass.

The missionary writes that the pygmies eat the roasted corms, and that the elephants are also fond of the corms, "tusking" them out of the ground for food.

THE AROID LILY (**ZANTEDESCHIA**) IN AUSTRALIA

FRED M. DANKS, *Australia*

Just what we in the isolated spaces of this Island Continent can offer in improved Zantedeschias or AROID LILIES is a question that only can be answered by the interchange of information, but in the comparison of conditions alone something can be learned, and there is the question of reversal of seasons to take into account. It may be possible to gain an advantage from this in breeding by having forcing stock from the opposite hemisphere to bring into flower when pollen is needed.

So far as varieties are concerned, the species are relatively fixed, but among the hybrids it may be that the range we have has something different to offer, and an exchange of seeds might help.

Some breeding has been done already mostly in the way of increasing stocks, and the better types have been isolated, but in addition some regulated crosses are being handled and in due time something good will show. New Zealand claims "Whiteley Hybrids," but the origin seems obscure, and Chandler of Tecoma raised a number of varieties some years ago. Gilbert Errey of Lilydale too had some of the larger pinks. A. S. Goen of Bluff Hussary Loorabbas has a good range.

More progress can be expected for the growing conditions are as favorable as in the best of the Californian areas. The problem is to grow thousands of corms in a small area. There is here a good market for blooms and corms.

Here seeds can be sown as soon as the frosts are over—in early September—and the seedlings form handy size "buttons" the first year in good soil, and give full flowering corms the next year.

The reversal of seasons is quite another matter and might be worthy of a trial. Corms are available to any who are interested. The normal season of flowering is in January and February here, and it would seem that the corms ripen here should respond the same in the Northern Hemisphere in winter if given suitable growing conditions. Someone in England has tried out the idea and has paid a high figure with air transport—seemingly not necessary—into the bargain. Even as a source of supply, the stocks here are relatively low in cost in comparison with European grown corms. Such out of season blooming should be welcomed by florists. If carefully packed, the corms should travel well, but import permits will be necessary. Corms are ready in June and July, and seeds just a month or two earlier.

THE **ZANTEDESCHIA** (CALLA) INDUSTRY IN CALIFORNIA

H. M. Butterfield, *Agriculturist,*
Agricultural Extension Service,
University of California, Berkeley

Zantedeschia (Calla Lily or Aroid Lily) is grown extensively in California, both in home gardens and commercially. A survey made of the bulb industry in California several years ago showed that Santa Cruz County had 2,195,650 yellow callas *(Zantedeschia Elliottiana)*, 1,411,-425 white callas *(Zantedeschia aethiopica)*, 35,000 "albomaculata" callas *(Zantedeschia albomaculata)*, and 16,000 black callas (possibly *Arum palaestinum*).

The yellow calla has been the leading commercial variety grown in California and is prized more than any other variety, being planted mostly as a pot plant by those who buy the field grown bulbs. Flowering potted plants are sold by many florists. The roots or corms are treated much like a true bulb and must have good drainage to escape root troubles.

Zantedeschia albomaculata has either creamy yellow or milk-white flowers with a blotch of crimson at the base. The leaves are spotted with white like those of the yellow calla. Judging from the number of field-grown corms, this species is also popular.

White callas are available in different forms or varieties. Minor or Little Gem is one of the dwarf varieties grown. Godfrey is another dwarf variety. Such dwarf kinds may grow to good size under favorable field conditions but when confined to a small pot they produce the smallest flowers. If planted in good soil in the garden, these dwarf kinds are often disappointing because they are not sufficiently dwarf and the flowers are too large. A very large white calla, known as var. *grandiflora* has been grown occasionally. Sometimes a double or hose-in-hose form is reported but is never common.

The common white calla was brought to California with the first American nurserymen and was listed by Col. Warren of Sacramento in 1853. From that time on the calla has been a common door-yard plant in many home gardens near the coast where freezing weather is absent in winter. The reason why callas have been grown so extensively in California may be attributed to mild weather in both winter and summer and to the dry summers which permit good drainage in most soils. Continued wet weather or excessive irrigation has caused serious damage to commercial plantings.

The pink or rose calla, *Zantedeschia Rehmannii*, should be mentioned, although it is relatively unimportant under field conditions. It is limited almost entirely to greenhouse culture and is often used as a potted plant.

The black calla *(Arum palaestinum)* grows well outside in the coastal area of California under the same soil and climatic conditions where

white callas grow. The flowering season is early. This species has been imported into California many times in earlier years. One such importation came in from England about 1880 but similar importations are reported. The dark colored flowers appear in late winter or early spring and do not last very long. They have a musty wine odor but are not offensive like *Helicodiceros muscivorus* flowers or flowers of *Dracunculus vulgaris (Arum dracunculus).* Still another related plant is *Arum italicum,* often seen in California gardens where the white veined green leaves and greenish flowers appear more or less unnoticed but the plants are enjoyed primarily for the yellow seed clusters that develop later in the year after the leaves have died down. *Amorphophallus Titanum* from Sumatra has been called the largest flower in the world and belongs to the Arum Family. A corm of 113½ pounds and spathe of 4 feet across was reported from the New York Botanical Garden in 1937. *Hyrosome Rivieri (Amorphophallus Rivieri)* has been planted only occasionally in California gardens and has no promise as a commercial crop. Still other related genera may be classed as oddities without much horticultural value.

Commercial growers of callas have to contend with root rot due to the fungus, *Phytophthora richardiae,* confined to the white callas. Starting with healthy plants is important in avoiding this trouble. Soft rot, due to *Erwinia arpideae,* has not yet been serious in California. Chalk rot often injures the roots. Leaf Spot, caused by the fungus *Phyllosticta richardae,* has occasionally been serious in the coastal area of California. Good drainage and starting with healthy planting stock on new ground will usually avoid most of these troubles.

The future of the calla industry in California will depend mostly on demand and prices. No adequate recent figures are available to show the total acreage of callas in leading counties nor the total value per acre. We might look at the acreage of callas in San Mateo County in 1945 when 57 acres were reported and were valued at $117,119. This is at the rate of more than $2,000 gross value per acre, which might seem to indicate great promise for commercial growers. The sale of the "bulbs" will doubtless continue to be the primary outlet. No doubt some callas are being shipped to eastern florists but the amount is not large. California growers can produce any amount of calla corms or cut flowers that buyers will take at a good price. The cost of irrigation and hired labor will continue to be high and most growers will study carefully to see which crop leaves the best margin of profit. Callas may not be as profitable to the grower as some other crops that do well on the same land. As long as demand is limited the grower will continue to give most of his attention to other flower crops and vegetables which do offer a good income per acre.

THE **ZANTEDESCHIA** (Calla) INDUSTRY IN FLORIDA

WYNDHAM HAYWARD, *Florida*

The memory of even the oldest old timers runneth not to the contrary when some forms of the white calla *(Z. aethiopica)* were not grown in Central Florida gardens. At present CALLA LILIES are one of the commonest water-side plants, and are also cultivated for winter bloom in pots, urns, tubs, beds, bog gardens and other similar places in all parts of the Sunshine State.

Only in those sections providing an abundance of rich, moist mucky soil, which can be raised into beds for a certain amount of drainage, has the commercial culture of the white CALLA LILY arrived at a major importance. This situation prevails over the Central part of the state, in the lake and low hammock country, with Orlando as a central point.

Even veteran horticulturists of the State Experiment Station do not recall when callas were introduced into Florida. The late Henry Nehrling, in his work "My Garden in Florida," Vol. 1, writes that a "Mr. Bunek" at Eustis, years before, grew the white calla *(Z.aethiopica)* "permanently in a mucky, shallow pond with much success." Once established the plants can stand water a few inches deep over them for weeks at a time.

In ordinary Florida garden and commercial culture, the variety of *Z. aethiopica* commonly planted is the semi-dwarf type known as the GODFREY. This is intermediate between the large-flowered type, and the variety known as LITTLE GEM of BABY CALLA, which seldom gets more than a foot tall. The GODFREY grows to two and a half or three feet tall, and sometimes more in shady places. The larger variety or common *Z.aethiopica* will grow nearly twice as tall as the GODFREY, under the most favorable conditions. In the usual muck bed commercial plantings in Florida the GODFREY calla grows between two and three feet tall. The handsome white spathes top the graceful arrow-shaped leaves by a few inches at their optimum growth.

The GOLDEN CALLA, *Z.Elliottiana,* has been grown in Florida for thirty years at least, but not commercially for the propagation of the bulbs. Tubers are imported from California to grow in garden beds or as pot plants by home horticulturists or florists. The pink calla, *Z.Rehmanni* and its varieties have been tried in Florida for 10 or 12 years and every season a few pots of this are seen as novelties at the flower shows in spring, but as in the case of the GOLDEN CALLA, the bulbs are difficult to "hold over" in the summer, with any success. They are subject to various rots, decays, and also the root-knot nematode is damaging to them in sandy loam soils, where this pest is present

The white callas are also subject to damage by the root-knot nematode in Florida in sandy soils, but this pest is not usually a serious problem with the heavy types of mucky soils where the callas are usually grown. The root-knot nematode does not thrive in such heavy, moist soils.

There is a large occurrence of rot among the white calla rhizomes when dug and stored every summer, as is the custom in large plantings. In some cases the loss may be 30 to 50 per cent or more among the bulbs dug and stored in ventilated sheds, due to the hot, humid weather which prevails in Florida in the summer, while the bulbs are supposed to dry out. Possibly the use of a heated dryer such as is used by California growers would help this situation. However, usually the plantings are not large enough to bring about the adoption of such measures of efficiency.

Often GODFREY calla plantings are made along a lake shore, or in a piece of hammock muck land sloping down to a creek or "branch." Often the edges of bay-heads or cypress "bottoms" are utilized. Lake-side locations are more desirable as they offer more protection against frost. Any cold wave bringing temperatures below freezing, even down to 30 or 28 degrees F. for a few hours, will cause a serious loss to any calla planting. A sharp frost may cut down all blooms and buds in a calla planting and severely injure the foliage on plants. In the past 15 years there have been several "freezes" which killed the main Florida calla plantings to the ground. However, the plants have great vitality and "come back" in a few weeks, almost as good as ever.

It is best to cut off and remove foliage damaged by cold after a severe freeze in a calla planting, as the frozen foliage soon decays and the decay may go down the main stem and destroy the main tuber of the plant. This means that the whole corm may become decayed by digging time in early summer, or only a few of the larger offsets may survive.

Operation and maintenance of a successful calla planting requires plenty of hard toil and conscientious attention to detail. Preparation of the "muck patch" from its primeval woods is a heroic task like clearing land for celery plantings in the Florida hammocks. After the soil is broken up and made into beds and all roots removed, the calla rhizomes or corms are planted in rows, 6 inches to a foot apart in the row and the rows 2½ to 3 feet apart on the bed. Some growers run the rows the long way of the beds and some crosswise. It makes no difference except as the ease of cultivation and picking the crop figure in the matter.

The calla beds of rich, damp, mucky soil are made up freshly every summer, and the corms that have survived the drying-off period in the bulb shed trays are re-set. This usually takes place in late August or September. By Christmas, with reasonable rains and a monthly fertilizing with any good vegetable mixture rather heavy in potash (say a 4-5-6) the first flowers will appear. The early blooms are usually inferior and many are defective, but when the plants have gained full foliage, by mid-January, fine blooms appear.

The flowers are picked usually in early morning and late afternoon. In the warm part of the day they are soft and easy to damage in the picking process. When picked they are brought to the packing shed, which may be the grower's back porch, and placed in tall containers of cool water for several hours. Then they are packed in the shipping boxes of corrugated cardboard, one layer over another, and each layer with its

flowers a few inches below the one beneath. When the box has received all the flowers it will hold, the stems are fastened firmly with cleats between the sides, the box is covered, tied and labeled for shipping. From 50 to 150 calla blooms, depending on size, can be packed in a single box, of the usual size, 4 to 5 feet long, 18 to 22 inches wide and 8 to 10 inches deep. These shipping boxes are of the common corrugated cardboard.

Calla lilies packed in this way are shipped by railway express to Jacksonville, Birmingham, Atlanta, and to points in Virginia, the Carolinas and occasionally to places as far away as Chattanooga, Tenn., and Washington, D. C. However, these blooms are not regarded as "carrying well" on longer shipments, as to New York and Chicago. The advent of cheaper air freight rates may change this picture. The express charges on a box of large callas would be a disadvantage to successful shipping to New York and similarly situated large cities in the North, even if this could be done feasibly. For shipping within 500 miles or slightly more the calla is well adapted.

In the Orlando area there are numerous calla farms, mostly side issues for citrus growers, real estate men, horticulturists, florists, etc., of ½ to several acres in extent. Some ship as many as 30,000 calla blooms a season. The individual calla corm of large size may produce as many as five to seven blooms in a season. A small GODFREY calla bulb will bloom at ½ to 1 inch in diameter of the rhizome, but to produce the larger and more desirable flowers, a corm 1 to 2 inches in diameter is required. The large flowers of the *Z.aethiopica* type commonly grown in California are not popular in the Florida trade.

Because of the large losses in rotted rhizomes, the Florida growers seldom have more than enough bulbs at the end of the season to give them their usual expanded planting. In many cases they will have less corms at the end of the season than they had when they started. Sometimes the loss of corms in summer storage is heavy, at other times not serious, but usually there is no surplus of the larger rhizomes, so it is often difficult to obtain corms by purchase, unless cormlets are bought by the bushel.

The Florida Agricultural Experiment Station has studied the problem of the decay of calla rhizomes and has made recommendations for various fungicidal baths and dips for the corms. But the fact remains as much a matter of cultural technique and physiology of the plant as anything, in the opinion of veteran growers. Many of these feel that a calla rhizome, properly fed with adequate potash during the season, and not excessively forced with a high-nitrogen fertilizer, dug when mature, carefully cleaned, and dried in the shade, will stand off decays as well as a dipped bulb which has been given improper culture and careless treatment in digging and drying.

The drying of the corms in storage seems to be a process quite different in the case of the GODFREY calla than in the California type of the large-flowered *Z.aethiopica*. California produces a crop of dried, cured *Z.aethiopica* corms numbering many thousands annually, which are largely sold in the Midwest, North and East for greenhouse calla culture.

Florida produces virtually no calla rhizomes for sale in the florist and bulb trade, either GODFREY or *aethiopica*. The *aethiopica* or large calla type grows well in Florida, but tends to die out in the hot Florida summers and gives more trouble in storage from decays than the GODFREY.

A new planting of the GODFREY calla is usually started from cormlets, which may be purchased in quarts or bushels from growers having a surplus. No Florida grower ever had a surplus of large GODFREY corms to this writer's knowledge, due, as stated, to the heavy loss of the larger size corms in summer storage, no matter what treatment is given them. The cormlets and small offset corms usually keep much better in storage.

Some growers wash off the muck around the calla rhizome at digging time in June or July. Others leave the corms in a clump of muck just as dug. They have both good and bad luck in keeping the bulbs during the summer either way. Before replanting in both cases, dried corms, dirt and smaller offsets are removed from the larger ones.

Fertilizing is usually accomplished by simple side-dressing, scratched gently into the top muck. Little weeding is necessary after the first six weeks, as by Christmas time in a well-grown calla patch, the foliage will cover virtually all of the ground. Sometimes a heavy rain on the calla bed shortly after planting, as during a September hurricane, will create a soggy condition which will rot a good part of the unsprouted rhizomes just as they are, freshly planted in the muck. This is one of the hazards of the industry along with frosts.

Some growers protect their planting from frost and cold by burlap sack screening overhead and on the sides. Some use heaters, but a severe freeze will usually create considerable havoc in any calla planting regardless. The advantage of heating facilities lies in the earlier return of plants to full blooming after a cold spell, which may mean considerable profit to the grower if his neighbors' calla plantings were severely damaged.

As an ornamental, the calla will survive for years in a Florida lake-side planting. When not subjected to the high pressure of heavy fertilization, cultivation, digging and storing, it takes its own leisurely time about blooming, but presents a handsome appearance in bloom and out in any reasonably frost-free pool or lake-side planting, even a few inches under water. The GODFREY calla seems to prefer an acid soil.

Upper, part of a collection of various *Araceae* naturalized in the overflow of a huge spring on 300 acre ranch high in hills where Len Mirzwick made his home for 30 years. Note Mr. Mirzwick; tall iris and string pull to camera.

Lower, Len Mizwick's new location for past 4 years on city lot, showing *Zantedeschia* beds.

Plate 8

ZANTEDESCHIA AND OTHER ARACEAE

LEN MIRZWICK, *California*

Over a period of years in Sonoma County, California, I have grown a number of *Zantedeschia* species, and other Araceae (Plate 8). The Zantedeschias are all native to South Africa and Tropical Africa, but various other *Araceae*, while found mainly in African and South American jungles, range northward to the temperate zone, many being found in Japan, China and India. Some are intensely fragrant while others give off offensive odors to attract insects. A few of these are a sight not-to-be-forgotten when in flower. Many species are used in medicine, mostly for coughs and colds. Some are chewed by natives of tropical islands as an exitant before warring on neighboring islanders, and many are of a poisonous nature. Others are used as foods in various parts of the world.

Among those grown by the writer over the past 15 years are the following:

ZANTEDESCHIA SPECIES

The *Zantedeschia* species are my chief interest at present, and a number of these are cultivated. The following is a brief statement about each of the species and forms grown.

ZANTEDESCHIA AETHIOPICA. The white CALLA LILY, or IMMACULATE AROID LILY is well represented in my collection, including the type and several forms. (1) The tallest is PEARL VON STUTTGART which is apparently a sport of the type. It attains a height of 7 ft., or more, and has enormous snow white saucer size, widely flaring spathes with prominent recurving tips. The spadix is up to 8 inches long, and the leaves are shiny-green and free from spots. (2) The waxy-white type of *Z. aethiopica* is much desired at Easter time, and is planted in tubs and pots. The leaves are shiny, and the flowers appear from December through June. (3) The GODFREY clone is more slender and dwarfer than the type, and is fine for cutting. The spathes are marble white, with yellow spadix. (4) The yellow-leaved *Zantedeschia* has spathes like GODFREY but the leaves are nearly as yellow as the spadix; it grows to 14 inches high, and is rather difficult to propagate; the blooms appear from June to August. The rhizomes are much like those of GODFREY. (5) The clone Midway is the next in size between GODFREY and LITTLE GEM. The spathe is pure white, the spadix yellow; it blooms from December to June and is quite fragrant and more resistant to frost than the other two above. (6) The clone LITTLE GEM (syn.— BABY *CALLA*), the smallest and whitest of all, is like the type but only 8 to 10 inches tall; the spathe is about 2½ inches long, marble white with yellow spadix; it blooms from December to July, and is used quite extensively for corsages. It can be forced to bloom for Christmas and Easter as potted specimens.

ZANTEDESCHIA ALBOMACULATA. In this the leaves are marbled and very decorative; it blooms from June to August, and must have lots of water; the spathe is ivory white.

Apparently the clone, NEW CREAM, belongs here for it was found in a shipment of *Z. albomaculata* and is probably a sport of it. In growth it is robust, blooming from June to July; the spathe is rich cream color, with a slight dark blotch in the throat. It is lovely and spectacular.

The clone, *Z. Nelsonii* is similar to *Z. albomaculata.* It is robust, growing to 3 ft. tall; the leaves are rather thick, bright green, and spotted somewhat as in *Z. albomaculata* (type); the flowers appear from May to July, lasting longer than those of any other yellow *Zantedeschia;* the spathe is cornucopia shaped, not flaring, pale yellow in color, with a purple blotch in the throat. This plant fails to die down until frost forces it to go dormant. It is a beautiful plant and should be more widely known.

ZANTEDESCHIA HASTATA (SYN.— Z. OCULATA). This is also known as *Richardia* "Pride of the Congo" (Rev. Hort. p. 27. 1893). It was sent to me many years ago by a friend, but it failed to survive. Attempts to obtain it again have all failed.

ZANTEDESCHIA ANGUSTILOBA (SYN.— Z. PENTLANDII). This species from South Africa is one of the Aristocrats of this genus. It has a very large and broad saucer-like spathe (See Plate 9.), the color of hammered gold; with a black-purplish blotch at the base inside; the leaves are green, quite thick; the blooms appear in June and July; the spathes remaining in good condition for a relatively long time.

ZANTEDESCHIA MELANOLEUCA. (See Plate 9.) This species is native to South Africa, and has straw-colored spathes, with velvety black blotch at the base inside. The flowers stand well above the leaves, on a rather thick stem; the leaves are blotched with silvery markings throughout; it is a lovely pot plant, as well as a show in the garden; the blooms appear through July and August.

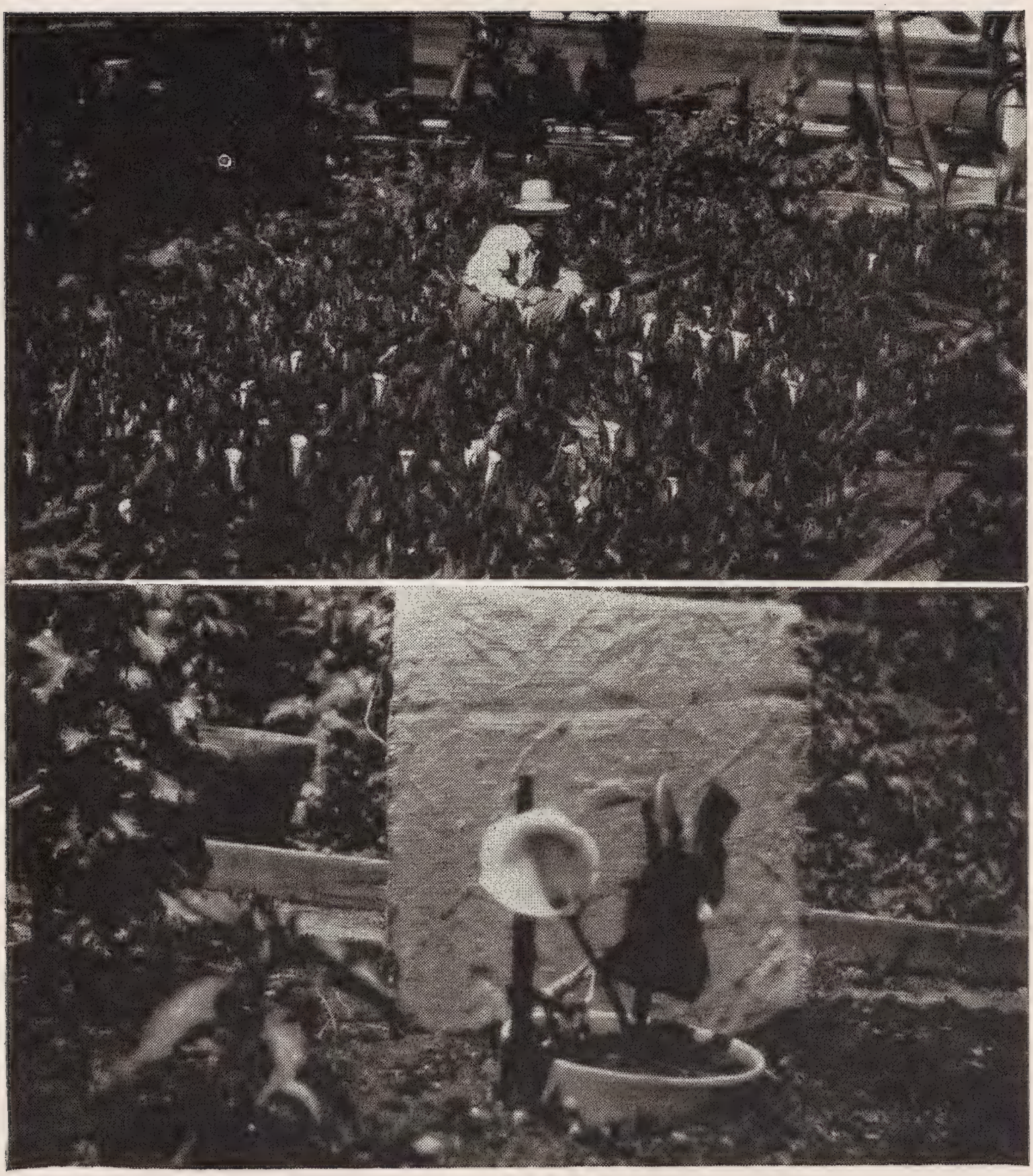
A clone, similar to the type, *Z. melanoleuca,* but in which the flower stalk and petioles are purple like the throat in the spathe, apparently belongs here. It appeared among thousands of seedlings of *Z. melanoleuca.*

ZANTEDESCHIA c. LEMON CREAM. This is a robust grower with thick, arrow-shaped leaves, splotched throughout with silvery markings; it blooms from June to August; the spathe is quite large, widely flaring, and tip recurving; it is of a soft lemon shade, with yellow spadix, and slight blotch inside the spathe. A lovely plant.

ZANTEDESCHIA ELLIOTTIANA. This is the GOLDEN AROID LILY, or GOLDEN CALLA. It has a deep lustrous yellow spathe, and blooms in June and July, the flowers lasting well, and turning green in a few weeks. It has no black blotch in the throat.

Here belongs the clone which is like the type, *Z. Elliottiana,* but has leaves like those of *Z. albomaculata.* It blooms during May and June. It is very odd and unusual, and is probably a sport rather than a hybrid.

ZANTEDESCHIA REHMANNII. This is the PINK or ROSE CALLA. The spathes range in color from the palest blush pink to a rich rose; very rarely they are white. It is dwarf and compact, and likes lots of water, and some shade. The blooms appear during May to July.



Upper, portion of Len Mirzwick's *Zantedeschia* beds during summer growing season, planted to *Z. melanoleuca* for seeds and corms.

Lower, *Z. angustiloba* (syn.- *Z. Pentlandii),* in pot culture, is slow to propagate, but pollen for hybridizing has been produced for himself and for shipment to other breeders.

Plate 9

The clone, *Zantedeschia Rehmannii* c. STRAWBERRY RED, is quite different from the type in that the spathe is a beautiful dark strawberry red in color. The plant is larger, growing to 2 ft. tall, and it holds better. The leaves are lance-like and grow very thickly from the corm that produces from 4 to 6 lovely blooms from May to July.

OTHER **ARACEAE**

I have grown 17 species, representing 5 genera of the *Araceae* other than the *Zantedeschia* species and forms indicated above. These will be briefly discussed under the five genera.

ARUM. (1) *Arum italicum*— leaves long and broad, light veined; flowers short, stocky, yellow and white, rather straight; spathe slightly swollen below; the flowers appearing in late April and lasting about five days; the tubers can be lifted in July or can be left in the beds. (2) *Arum Palaestinum*— Big flower spathe, dull black-green on outside, midnight velvety maroon inside; tip of spathe sometimes recurved. Native to Palestine and sometimes referred to as Solomon's Lily. (3) *Arum Dioscoridis*— *Spathe* tube pale within; limb about 6 inches long, splotched with purple spots; spathes may be marked differently; the bulb in this collection had a 14-inch spadix, spathe 14 inches long, 6 inches wide, and stood erect many days before opening; odor slight at first but none after a few days. A beautiful flower reminding one of the tropical jungle. (4) *Arum crinitum*— [= *Helicodiceros muscivorus*], the TWIST-ARUM; the spathe is very hairy, and has a bad odor that attracts insects, and even buzzards. It is from Corsica. (5) *Arum biarum Bovei*— A small arum collected in Palestine; a low growing plant, said to have BLACK CALLA like flowers before the leaves appear. I had this for many years but it never flowered. Native to Syria and Palestine. (6) *Arum maculatum*— Known in England as WAKE ROBIN; it is short in growth, slightly more than a foot high; leaves luscious green, black spotted; flowers in May for just one day, then withers; the spathe is contracted above the base, with tendency to incurve or inroll, giving the spathe an odd appearance; spathe white with purple spots. There are five other forms, but this is believed to be the type. It is native to northeastern Europe, and was used by the ancients as an exitant. (7) *Arum arisaema* [= *Arisaema triphyllum Torr.*] The well-known JACK-IN-THE-PULPIT; also known as INDIAN TURNIP; very odd hooded, the spathe inrolling over the spadix, which ripens into a cluster of red berries; spathe light green; very easily grown and will spread rapidly. Native to North America. I have collected it in the birch swamps of New Jersey. (8) *Arum cornutum*— SNAKE LILY; similar to *Sauromatum guttatum* in habit, flowering from dry corms in early spring; the spathe is red, spotted black, very curious; the foliage is palm-like. (9) *Arum* (ST. CLAIR PURPLE). This plant is tentatively so named because it is as yet unidentified. The only purple *Arum* that I know; it blooms in February in the garden; is about 14 inches tall; the spathe is a beautiful purple, completely stretched out, then gradually inrolling, showing a green mar-

gin. It is the hardiest arum that I know of, frost and ice may come but it just keeps on growing.

ARISAEAMA DRACONITUM. Known as GREEN DRAGON. This unusual plant has a single large leaf divided into 7 to 9 segments; it blooms in May, the flowers lasting only a short time; the spadix extends far above the spathe which is wrapped around it; bright orange clusters of fruit (or berries) resembling kernels of maize form on the spadix; these sprout readily around the plant in the wild state. This plant will naturalize and take over the garden if not held in tow. It is known as the DRAGON PLANT of America in contrast with *Dracunculus vulgaris,* known as the DRAGON PLANT of Europe.

DRACUNCULUS. (1) *Dracunculus vulgaris*— Also known as the DRAGON PLANT of Europe; the dragon fingered leaves are odd and interesting; the tube of the spathe is purple-streaked; the spathe is purple throughout but much more so along the border, especially the wavy edges; it blooms in May, lasting 4 or 5 days, and smells to very high heaven. (2) *Dracunculus canariensis*— It blooms from dry corms which are very tender and may rot easily; the blooms appear in April; it is very smelly but interesting; the leaf-lobes and the spathe are narrow.

SAUROMATUM. (1) *Sauromatum nubicum*— Much like *S. guttatum* and requires the same care, but the flower-spathes are enormous and deep maroon, yellow marked; it is easily attacked by rot. (2) *Sauromatum guttatum*— Known as MONARCH OF THE EAST; the flower stem is beautifully marbled; the dry corms placed in the east window will have rose-tinted, purple-streaked ivory flowers; flowers last but a short time; the corm should then be placed in the garden where the beautiful leaves will be produced; the corms bear a single leaf one year, and flower the next; the flowers appear in June and July, lasting but a few hours. (3) *Sauromatum venosum*—Known as LIZARD LILY; the leaves are 10 to 12 inches long; the flower is purple on black and it is yellow within; this is supposed to be the same as *S. guttatum,* but my bulbs are different; my *S. guttatum* has beautiful "Sugar Pine diamonds" up the stems, *S. venosum* has not; *S. venosum* is an interesting plant from the Himalaya Mountains.

AMORPHOPHALLUS. (1) *Amorphophallus Rivieri*— Known as AFRICAN or SNAKE LILY, and also as DEVIL'S TONGUE. The scape precedes the leaves in early spring; the flower is dark with red speckles; the very large, often 3 ft. long, spadix is dark red, and has a very offensive odor; the blooms appear in May and June, lasting about 6 days. (2) *Amorphophallus Mozambiquana*— The velvety maroon flowers appear in late winter from a dry corm; it is very unusual, and difficult to start and keep growing.

ADDENDA

The following names pertaining to the genus *Zantedeschia* came to light after the article above was set in type.

Calla Pentlandii Hort. ex Kew Bull. (1893), append. 2: 30. = *Zantedeschia angustiloba* (Schott) Engl.

Arodes albomaculatum Kuntze, Rev. Gen. 740 = *Zantedeschia albomaculata* (Hook. f.) Baillon.

Arodes melanoleuca Kuntze, Rev. Gen. 740. = *Zantedeschia melanoleuca* (Hook. f.) Engl.

Hybridizing the Aroid Lily

As we go to press word is received from Clark L. Thayer, Dean, School of Horticulture, University of Massachusetts, Amherst, Mass., that a graduate student at that University, Miss Betty Lou Travis, is working on the hybridizing of the AROID LILY or CALLA, *Zantedeschia*.

THE GENUS **ZANTEDESCHIA**— INDEX TO GENERA, SPECIES AND CLONES

(Continued from page 32)

Generic names are in capitals (ZANTEDESCHIA); valid species names are in capitals and small capitals (ELLIOTTIANA), or in small capitals (AETHIOPICA); cultivated clones are in capitals and lower case (Little Gem); and all others are in italics *(Richardia Rossii)*. Figures after the names refer to page numbers in the text.

AARODES (Heist. et Fabric.) ex Kuntze, 10
aethiopicum, 12
albomaculatum, 46
angustilobum, 16
hastatum, 20
melanoleuca, 46
AROIDES Heist. ex Fabric., 10
angustilobum, 16
hastatum, 20
CALLA Linn., 9
aethiopica, 9, 12
"Fragrance," 13
Little Gem, 14
ambigua, 12
Elliottiana, 9, 20
fragrans, 13
generalis, 12
occulta, 32
oculata, 9, 20
Pentlandii, 46
COLOCASIA Link, 10
aethiopica, 12
OTOSMA Rafin., 10
aethiopica, 12
RICHARDIA Kunth, 9, 10
Adlamii, 31
aethiopica, 12
Little Gem, 14
africana, 12
albomaculata, 9, 14
angustiloba, 9, 16
aurata, 28
cantabrigiensis, 29
curata, 28
devoniensis, 14
Elliottiana, 20, 25
hastata, 9, 20
intermedia, 30
Lehmannii, 25
Lutwichei, 20
Lutwychei, 20
Madame Fosca Ragionieri, 30
macrocarpa, 16
melanoleuca, 9, 22
tropicalis, 24
nana, 14
nana compacta, 14
Nelsonii, 31
nilotica, 25
pallida, 30
Pentlandii, 16, 17, 20, 25, 29
Rehmanniana, 25
Rehmannii, 25
carminea, 26
Rossii, 22
Solfatare, 30
Sprengeri, 9, 25
Stehmannii, 25
suffusa, 31
Taylori, 29
ZANTEDESCHIA Sprengel, 8, 9, 10, 12, 27
AETHIOPICA, 8, 9, 11, 12, 13
Baby Calla, 14
candidissima, 13
Childsiana, 14
Childs Perfection, 14
Devon Beauty, 14
Fragrance, 13
gigantea, 13
Godfrey, 14
Godfreyana, 14
grandiflora, 13
Immaculate Giant, 13
Little Gem, 14

ZANTEDESCHIA (continued)
Midway, 14
minor, 14
Pearl von Stuttgart, 13
Snow White, 13
Sweet Perfume, 13
umganiensis, 13
ALBOMACULATA, 11, 14, 15, 18, 28, 29, 31
latifolia, 16
Alda Mi, 32
ANGUSTILOBA, 11, 16, 17, 20, 22
aromatica, 32
asperata, 32
aurata, 28, 29
cantabrigiensis, 28, 29
Mrs. Roosevelt, 28, 30
chloroleuca, 16
Chromatella, 32
Cynthia, 30
ELLIOTTIANA, 11, 20, 21, 22, 28, 29, 30, 31
Golden Glory, 32
HASTATA, 11, 19, 20, 28, 29
Lathamiana, 28
Lemon Cream, 31
Lutwychei, 20
macrocarpa, 9, 16, 17, 18
MELANOLEUCA, 11, 22, 23, 28, 29, 30
concolor, 24
tropicalis, 24
Nelsonii, 28, 31
New Cream, 28, 31
occulta, 32
oculata, 20
Purple Heart, 32
Ragionieri, 30
Madame Fosca Ragionieri
REHMANNII, 9, 11, 18, 25, 26, 27, 28, 29, 30
Australian Beauty, 27
California Pink, 26
Carmine Queen, 26
elegans, 26
Pink Lady, 26
speciosa, 26
Strawberry Red, 26
violacea, 30
Violet Queen, 27
Solfatare, 28, 30
SPRENGERI, 11, 24
Stehmannii, 25
Taylori, 29

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TABLE OF CONTENTS

Cover design, by Hamilton P. Traub, based on *xAchimenes* cl. PURPLE KING. Its flowers are not purple but violet (RHS Color Chart 36); it has an ideal upright habit and blooms for a very long time.

Note to members and librarians ---- 4

PLANT LIFE, VOLUME 5, NOS. 1-3. 1949—GESNERIACEAE EDITION

Preface ---- 6
Corrigenda, PLANT LIFE Vol. 4 (1948) 1949 ---- 6
Monograph of *Gesneriaceae* Needed ---- 7
Experiences with *Achimenes*, by E. Frederick Smith ---- 7
The *Achimenes* Come Back, by Wyndham Hayward ---- 21
The *Gesneriaceae* as a Hobby, by The Moshers ---- 25
I. *Achimenes* ---- 25
II. *Achimenes tubiflora* ---- 26
III. *Kohleria picta* ---- 27
IV. Hybrid Naegelias ---- 28

PLANT LIFE, VOLUME 5, NO. 4. 1949—HERBERTIA: AUSTRALIAN EDITION

Preface ---- 31
Corrigenda, HERBERTIA Vol. 15 (1948) 1949 ---- 32
Corrigenda, AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub & Moldenke ---- 32
Dedication ---- 33
Charles Osbourne Fairbairn, an autobiography ---- 35
Narcissus Lagacy of Clark, Radcliff, Nethercote and Jackson:
In Memoriam—Alister Clark, 1864-1949, by Harold Alston ---- 36
In Memoriam—William Jackson, 1865-1949, by J. R. Byfield ---- 38
In Memoriam—Charles Alfred Nethercote, 18??-1949, by Harold Alston ---- 39
In Memoriam—C. E. Radcliff, 18??-1949, by J. R. Byfield & Harold Alston 40
Horticulture in Australia, by Fred M. Danks ---- 44
1. REGIONAL ACTIVITY
Daylily Report, 1948, by Elmer A. Claar ---- 45
New Orleans Amaryllis Show, 1949, by Mrs. W. D. Morton, Jr. ---- 49
Autumn Amaryllis Show, Pomona, Calif., 1948, by Cecil Houdyshel ---- 49
2. SPECIOLOGY
Australian Amaryllids, by J. H. Willis ---- 51
Karyology of Some South African *Amaryllidaceae*, by Josef Benjamin Gouws 54
Allium tricoccum Notes, by Thomas K. Barrie ---- 81
Amaryllid Notes, Hamilton P. Traub ---- 82
A Pink *Amaryllis*, by Mary G. Henry ---- 83
Amaryllid Genera and Species, by Harold N. Moldenke ---- 84
USDA Daylilies ---- 86
Registration of New Amaryllid Clones ---- 87
Hybrid *Amaryllis* Clones ---- 88
Hybrid Daylily (*Hemerocallis*) Clones ---- 88
Corrigenda: Descriptive Catalog of *Hemerocallis* Clones, 1893-1948 ---- 90
3. GENETICS AND BREEDING
Hybrid *Amaryllis* Breeding in South Australia, by E. Both ---- 91
Hemerocallis Breeding—Hurst Band System, by Grafton W. Shults ---- 102
4. CULTURE
Daylilies in Australia, by Fred M. Danks ---- 103
Distant Shipping of Daylilies, by George Gilmer ---- 104
New Daylilies, by Philip G. Corliss, M.D. ---- 104
Eustephieae and *Eucharideae*, by Len Woelfle ---- 107
Growing Alstroemerias for Market, by Bruce Hinman ---- 111
Cowpeas—a Cover Crop for *Narcissus* plantings, by J. S. Cooley ---- 114

Notes on the 1949 Daffodil Season, by Grant E. Mitsch 115
Narcissus in a Maryland Garden, by W. R. Ballard 121
Narcissus Notes, 1948, by J. S. Cooley 123
South African Amaryllids as House Plants: Brunsvigias and xCrinnodonnas by Sarah V. Coombs 125
5. THE AMERICAN PLANT LIFE SOCIETY 131
Amaryllid Branch 131
Other Committees 133
Postscript Note (*Hemerocallis*) 134
Nomenclature of Some *Brunsvigia* Hybrids, by Hamilton P. Traub 134

ILLUSTRATIONS

PLATES

Plate 1. Herbert Medalist—Charles Osborne Fairbairn 34
Plate 2. 1949 Amaryllis Queen of New Orleans 48
Plate 3. Amaryllid chromosomes—*Haemanthus magnificus*, etc. 55
Plate 4. Amaryllid chromosomes—*Nerine sarniensis* (triploid), etc. 59
Plate 5. Amaryllid chromosomes—*Crinum forbesianum*, etc. 63
Plate 6. Comparison of amaryllid chromosome complements 70
Plate 7. Rootstocks—*Haemanthus magnificus*, etc. 73
Plate 8. The Pink Belladonna Lily, *Amaryllis belladonna* var. *Haywardii* 85
Plate 9. *xBrunsvigia Parkeri* cl. Zwanenburg 127
Plate 10. *xCrinodonna Corsii* cl. Fred Howard 128

TEXT FIGURES

Figure 1. *Achimenes mexicana* 9
Figure 2. *xAchimenes* cl. Ambrosie Verschaffelt 11
Figure 3. *xAchimenes* cl. Mauve Queen 13
Figure 4. *xAchimenes* cl. Periwinkle Blue 15
Figure 5. *xAchimenes* cl. Atropurpurea 17
Figure 6. *xAchimenes* cl. Dainty Queen 19
Figure 7. Portrait—Alister Clark, 1864-1949 37
Figure 8. Portrait—C. E. Radcliff, 18??-1949 41
Figure 9. Amaryllid chromosomes—*Haemanthus nelsoni*, etc. 67
Figure 10. Amaryllid chromosomes—*Crinum forbesianum*, etc. 69
Figure 11. Probable phylogeny of amaryllid groups according to Gouws and Traub 75
Figure 12. *xHemerocallis* cl. Mary Henry [USDA Photo] 87
Figure 13. *xHemerocallis* cl. Stephen Foster [USDA Photo] 89
Figure 14. Portrait—Mr. E. Both 91
Figure 15. Portraits—The Both Family and Friend 93
Figure 16. *xAmaryllis* cl. Both #11,086 95
Figure 17. *xAmaryllis* cl. Both #333, pure white 97
Figure 18. *xAmaryllis* cl. Both #6, orange-red self 99
Figure 19. *Hymenocallis rotata* and *H. tenuiflora* 108
Figure 20. *Hymenocallis macrostephana* and *Pancratium maritimum* 110
Figure 21. Cowpeas cover crop for *Narcissus* 114
Figure 22. *xNarcissus* cl. Cotterton, and seedling 116
Figure 23. *xNarcissus* cl. Foggy Dew 117
Figure 24. *xNarcissus* cl. Binkie 119

NOTE TO MEMBERS AND LIBRARIANS

The present volume is the fifth of the PLANT LIFE series. It is suggested that these five volumes be bound into one book for convenient reference. At the end of the present volume will be found a title leaf to be used for this purpose.

PLANT LIFE

VOLUME 5

[Nos. 1-3: Jan., Apr., & Jul.]

1949

GESNERIACEAE EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

PREFACE

Numbers 1-3 of PLANT LIFE, vol. 5, 1949, is devoted to the *Gesneriaceae,* a very interesting group that is gaining in public favor. In the present issue only a beginning is made toward the coverage of this important group. Other articles on this subject will appear in future issues of PLANT LIFE.

The cover design features *xAchimenes* cl. PURPLE KING, and illustrates the outstanding ornamental qualities that characterize the achimenes.

We are favored with most interesting articles by a number of *Gesneriaceae* enthusiasts. The Membership Secretary, E. Frederick Smith, makes his bow by contributing the stimulating article on "Experiences with *Achimenes,*" under California growing conditions, and Wyndham Hayward, the Southeast Regional Vice-President, favors us with a similar article "The *Achimenes* Come Back," detailing their culture in Florida. The Moshers (Dr. Kenneth H. Mosher and his wife) contribute interesting articles on various *Gesneriaceae*—"*Achimenes,*" "*Achimenes longituba,*" "*Kohleria picta*" and "Hybrid Naegelias." These articles are a foretaste of what is to follow in future issues on these fine plants and related genera.

In future issues of PLANT LIFE, in addition to the annual HERBERTIA number devoted to the Amaryllids, other plant subjects will also be treated—caladiums, anthuriums, palms, oxalis, etc. Past issues have been devoted to the *Verbenaceae,* the *Bromeliaceae,* spring- and summer-flowering *Gladiolus,* the history of the Dutch Bulb *Industry,* 1940-1945, and the Aroid Lily (Calla Lily), *Zantedeschia.*

—*Hamilton P. Traub*
Harold N. Moldenke

September 30, 1949

CORRIGENDA

PLANT LIFE, VOL. 4 (1948) 1949

Page 10, center of page, under "Genus ZANTEDESCHIA Sprengel," 1st line, change "1926" to "1826."

Page 13, Horticultural Selections, under (a), note that Pearl of Stuttgart is indicated as a dwarf, very floriferous variety with pearl white flowers, in Cat., H. de Graaff & Sons, Pittsburgh, Pa., 1949, p. 74.

Page 24, under 6a, Range.—, change "Nyassaland" to "Nyasaland."

Page 28, 10th line, between "Roosevelt" and "*xZantedeschia*" insert a semi-colon (;).
12th line, between "Bailey" and "*Zantedeschia,*" insert a semi-colon (;).
20th line, change "form" to "corm."

Page 30, 15th line from bottom, under "Notes," change "*Regionieri*" to "*Ragionieri.*"

MONOGRAPH OF GESNERIACEAE NEEDED

In a letter dated Oct. 17, 1949, C. V. Morton, Dept. of Botany, Smithsonian Institution, writes—"I am sorry to say that there is no complete monograph of the *Gesneriaceae*. The Old World species (under the name *Cyrtandraceae*) were monographed by C. B. Clarke in De Candolle's MONOGRAPHIAE PHANEROGAMARUM. *Achimenes* and other New World genera have not been monographed since Hanstein published in several volumes of LINNAEA around 1865. This treatment is of course long out of date and hardly of great value at present in identification work."

We are grateful to Mr. Morton for this information. It is hoped that some one with the necessary training and time will give us a modern monograph of this plant family.

—Editor

EXPERIENCES WITH **ACHIMENES**

E. FREDERICK SMITH, *California*

A Professor of Psychology should sometime be urged to assign, to one of his eager Doctors-to-be, the following problem: Why does this peculiar breed of humans called gardeners permit certain groups of charming plants to disappear from circulation?

Somewhere in the thesis there is bound to be a reference to the great *Achimenes* mystery. Over one hundred years ago Old World gardeners and plant breeders were carefully selecting and hybridizing *Achimenes*, using material that originally came from America. And as European gardeners emigrated to this country they brought along their choicest specimens, to adorn the greenhouses of the great estates and conservatories in which they worked. This continued until the early part of this century, at which time the *Achimenes* suffered an eclipse. It seems entirely possible that the disappearance of the old-time gardeners might account for the decline of interest in *Achimenes*.

The recent revival of interest in *Achimenes* shows promise of healthy growth. But it goes without saying that there must be general acceptance—and demand—on the part of plant enthusiasts for new and exciting introductions. Growers will not bother to produce quantities of *Achimenes* tubercles for an apathetic market; plant breeders will like-

wise hesitate to risk their time and talent in the face of a lukewarm interest on the part of the plant-buying public.

This plant-buying public is not entirely to blame, however, since so little is ever written in popular gardening periodicals to acquaint one with the charm and loveliness of this fascinating group of plants. So, with the hope that new converts may be won over to the *Achimenes* cause, or at least that a start be made in that direction, this is being written.

I have been your Membership Secretary for four full years, and during that time I have resisted many an urge to do a little writing for publication. The press of routine matters, however, always seemed to preclude the accomplishment of that desire. And then the Editor sent a request for an article on *Achimenes* for PLANT LIFE, Volume 5. Just like that.

So a large piece of wrapping paper is placed over the stack of unanswered letters on my desk. This is done for two reason: (a) the letters, if in plain sight, would have a distracting effect, and (b) a lot of dust might accumulate on them before this is completed.

It is but fair to warn you that this piece will be just about 100% non-scientific. I am writing this as a hard-working gardener who derives so much pleasure from the actual growing of plants in general that little time is left for the finer points of classification.

Another warning is in order. You do not grow just ONE single variety of *Achimenes*. Of course, if you are the kind of person who can stop after eating one salted peanut, you might possibly be content with a single variety of *Achimenes*. But my guess is that you will not be satisfied until you beg, borrow or swap as many as possible. As to the swapping part, it is not absolutely necessary that you possess horse-trading traits. But it certainly helps.

In order to make a start with *Achimenes* you must first purchase the bulbs, tubers, tubercles, rhizomes or roots. This may sound a little confusing, but it will depend on the particular bulb dealer with whom you place your order. One dealer may call them "tubers," another "roots," and maybe another will use as many as three of the terms in one single descriptive paragraph. But they all mean the same. When they arrive you are very apt to wonder if you were sent miniature pine cones by mistake, as that is what they really appear to be. The appearance, however, all depends on the variety. Some are short and fat (the "pinecone" type); others are long, thin and very fragile looking; many are intermediate: long-and-fat, short-and-thin. In fact, it is quite possible to identify many varieties by the size and shape of the tubercles, especially when color is also considered, since they range in color from white through pink to purple.

If in handling the tubers prior to planting you should accidentally break a few just consider yourself lucky. That may sound strange but you are working with a rather strange plant. If you plant one undamaged tuber you will have one stem; if you break the tuber in two you will have two stems—one for each section of tuber. Likewise, if you break it into four or more sections you will also have one stem for each portion. This can be carried too far, of course, for you must realize

that where you plant one single, undivided tuber you will have a vigorous growth response, since all of the stored-up energy is concentrated in one growing point. If segments are too small the newly-formed plant will need to build up a root system first, in order to manufacture food for further development. While it is doing this your one-tuber plant has raced on and will perhaps bloom several weeks ahead of the sectioned plants.

Fig. 1. *Achimenes mexicana*

The planting medium is a very important factor in successful *Achimenes* culture. In 1948 I used forest-run leafmold, throwing out only the larger sticks and stones—no screening whatever. This year I decided to treat them extra special and screened the leafmold through a half-inch-mesh screen, added about an equal amount of peatmoss and then some rotted cow manure. It sounds like a good mixture, and it looked fine. But the *Achimenes* didn't "think" so, and they showed their "dislike" for it almost from the start. Top growth was very slow in making an

appearance, and many of the less-vigorous varieties failed to show normal growth response after breaking through. Those grown in moss-lined wire baskets seemed to fare much better so one may conclude that drainage was not all that it should be in the pots and cans which were used for the most part. Even so, next year they are all going into containers with nothing but straight leafmold for the potting medium. They seem to require plenty of moisture but must have quick drainage, which are just the conditions leafmold provides. Unscreened, that is.

Plant-nutrient elements are quickly exhausted after the plants reach the bud stage, where leafmold alone is used, so it is necessary to feed them with a chemical fertilizer. Even with cow manure in the mixture it is beneficial to feed the plants regularly to keep them flowering well. A regular monthly feeding program is carried out, using liquid fertilizer. Fertilizer used in liquid form is much less apt to burn the foliage and roots, and is more quickly available.

Temperature is an important factor in the culture of *Achimenes*, especially in the early stages. They do best when the night temperature is about 60° F., or even a little higher. If forced to endure temperatures in the low fifties they practically stand still. They will make a feeble attempt to flower if you are lucky enough to get any size at all on them, but the flowers will be puny and just about completely off-type and off-color. These conclusions were reached after noting results following an experiment set up last spring. Identical lots were placed in a lath-house—subject to wind and weather—and in a heated greenhouse. The experiment needed to go no longer than two months, however, to prove conclusively that it is not worth the trouble to attempt to grow them under cool conditions. The plants in the lath-house were but a few inches in height, while the same varieties, in similar media, were growing vigorously in the warm house. Bailey's ENCYCLOPEDIA refers to them as "Greenhouse herbs" and the English and European gardeners term them "Stove plants"; both terms should cause one to hesitate about departing from standard practices. It is different with me, for I'm a confirmed experimenter and therefore have to find out the hard way.

Another test is indicated; one that might well be initiated by an experimentally-minded housewife: attempt to discover if *Achimenes* can be started in a kitchen window. It would seem entirely possible to do this successfully, especially where the home has thermostatically-controlled heat.

Once the plants are well started and ready to bloom they may be removed to the out-of-doors, in a situation protected from sun and wind. Flowering is somewhat slowed up but they will produce sufficient blooms to justify the care and space required. Results will of course depend on the region in which they are to be grown. In Southern California, Florida, Midwestern and Eastern States, and in the South generally, they should do nicely after the nights become warm. Conditions would be comparable to an un-heated greenhouse in this coastal part of California, where outside night temperatures average less than 54° F. during practically all of the summer months.

Achimenes are very "touchy" about strong light. After this year's collection was potted up in early April they were placed in a greenhouse with striped roof. Two-inch stripes of white, cold-water paint were applied about one-and-one-half inches apart on all roof glass surfaces. This afforded sufficient shading until early July, at which time severe burning of the leaves was apparent. The entire roof was sprayed with whitewash at this time, and all subsequent growth was normal following this total shading.

Fig. 2. *xAchimenes* cl. Ambrosie Verschaffelt

Significant results were obtained with one lot of surplus tubers that were placed in a warm house covered with Cel-O-Glass (galvanized wire fly-screen, impregnated with clear plastic). No attempt was made to shade the plants as they were strictly "on their own." They were newly-planted tubers, planted quite thickly in gallon cans—as many as 75 tubers to a can—and they made something of a record as to emergence. In fact, they grew so eagerly there was a temptation to move them to more "suitable" quarters. Lack of space, however, precluded such a

move and they remained right there. And there they still are (September 1st), growing and blooming at a great rate. Such unusual behavior rather forces one to conclude that there may be more to this material than meets the eye. Perhaps it screens out the infra-red rays, and possibly reduces the amount of ultra-violet rays. At any rate, the plants are growing lustily, with nary a sun-scald nor blister to mar their appearance.

Every African Violet fan should "take" to *Achimenes* like a duck takes to water. Assuming, of course, that a bona-fide fan is not passively content with merely buying a plant at a florist shop and then watching it grow. An honest-to-goodness fan finds a deeper and more exciting interest by growing new plants from leaves so they can be given away to friends, or swapped for new varieties. It is the same with *Achimenes,* only more so, since they have underground tubers that multiply at an incredible rate. For instance, in harvesting the crop in 1947 it was noted that one pot seemed to contain a staggering number of tubers. Since but two tubers had been planted the previous spring I undertook to count the total yield—but lost count after reaching 180. Not all varieties are this prolific, but even so, the national surplus would be something to really worry about if potatoes paid off like *Achimenes.*

If one is too impatient to wait for the harvest at the end of the growing season by all means use the leaf method of propagation to increase the population of choice varieties. Just take a pot, of suitable size to accommodate the desired number of leaves, and fill it with vermiculite. Then break off the older leaves from the lower end of the stems and insert them in the vermiculite. Keep them well watered and in about three weeks each leaf will have a well-developed root system and can be potted up. And in a very few more weeks they will be blooming and producing tubers. Just for the fun of it you might try planting half a leaf—the top half. You will be amazed to find that it will make a plant as quickly as an entire leaf.

If you prefer to make stem cuttings it will be necessary to first forget the standard rules for making cuttings. You do not cut below a node, to make a two- or three-node cutting; a single node is all that is necessary. But before you put into practice any of these easy methods for increasing your stock it would be well to estimate the amount of space available. They do take room—lots of it, if they are to be allowed to spread naturally.

A six-inch fern pot is an ideal size to use. This will accommodate up to a dozen tubers without crowding. Even half a dozen will make a good display by the time the secondary shoots have matured. The usual recommendation is to start the tubers in a flat of suitable soil, as is done with tuberous begonias, and transplant to pots after the shoots are about three inches high. This seems unnecessary—which is to say that I am too busy (lazy?) to follow this procedure; so mine are planted directly in the pots in which they are to grow for the entire season. When planting in hanging baskets the tubers are tucked into the moss as the layers of soil are being built up, so it would be impossible to pre-grow the plants for this usage.

Perhaps a more detailed description of my method of basket culture may be in order: Have ten-inch circles of one-inch lumber cut—preferably redwood or cypress. These can be made at any cabinet shop or lumber yard equipped with a band saw. Next procure the required amount of ½″ hardware cloth to form the walls of the baskets. It will take a nine-inch strip of the hardware cloth, one inch longer than the circumference of the circular board bottom, to make one basket. Staple one edge of the wire to the board and crimp the ends of the wire together —remember the one inch extra for lap—and you have an ideal hanging basket, ten inches in diameter and approximately eight inches deep.

Fig. 3. *xAchimenes* cl. Mauve Queen

In planting the basket it is necessary to use sphagnum moss to keep the soil from sifting through the wire, so have a quantity of the moss soaking in a bucket of water. Squeeze this out a handful at a time and place it in a band about two inches high along the bottom and force it into the mesh of the wire. It should be at least a half inch thick so that it will remain in place while the soil is being added. Prepared soil is poured to form a cone in the center and then pushed into the moss, the final level being about half an inch below the top of the moss. Now for the tubers. If in plenteous supply I place them about two or three inches apart where soil meets moss, in a complete circle. Since new growth is

initiated at the end opposite to the point of attachment to the parent plant I place that end nearest the moss, or, if in a hurry—which is usual —they are placed parallel to the wire. The reason for this is that the new shoot should not encounter too much difficulty in pushing through the moss and wire to reach the outside.

The remainder of the basket is built up in the same manner—one layer at a time. On the final layer the soil is pushed out higher at the outside to form a saucer-like depression for holding water. First, however, a sprinkling of tubers is made over the upper surface and covered with a half inch of soil, which gives a globelike effect in the final picture. Figure 1, showing *Achimenes mexicana,* represents a basket prepared and grown in this manner.

In my present collection of 35 varieties (incl. species) there are perhaps a mere half-dozen which are not suitable for basket culture. Of these, it is entirely possible that they, too, would respond with a small amount of training. *Achimenes* clone Harry William, with its stiff, purplish stems, will grow to considerably more than two feet in height, and remain in an upright position with a minimum of staking. It can also be trained to grow prostrate, as was done last year in an 8″ pot; the stems were bend down over the edge of the pot, and the ultimate spread was well over four feet. It was a truly remarkable sight when covered with a blanket of cerise-colored flowers. It might be mentioned in passing that this variety is the only one in the collection to produce stem tubers. All of the others produce their crop below soil level but this one forms large clusters of greenish, pine-cone-like tubers at the nodes. It also produces a generous quantity of tubers in the soil, which, added to the above-ground supply, adds up to a goodly yield.

There appears to be a difference of opinion as to the proper method of storing *Achimenes* tubers. Some are all for harvesting the dried tubers as soon as possible in the fall, storing them through the winter in dry sand, moss or vermiculite. This means double handling, since they will need to be handled again the next spring, at planting time. Others favor the practice of leaving the tubers right in the previous season's pots, allowing them to become completely dry and remain so through the winter. So, what with my chronic affliction (laziness), I heartily endorse the latter treatment. Come March and early April the containers are taken out of storage, tubers harvested and replanted into new pots and that's all there is to it. Important note: Storage temperatures should never go below 45° F.

Space will not permit a discussion of each variety individually so an attempt will be made to simplify descriptions by arranging in groups or pairs, those that possess similar plant forms, habits and flower patterns. In one group the three representatives are so nearly identical that it is sometimes necessary to look at the label to be certain as to the identity. These are *Achimenes* clones Royal Purple, Purple King (Cover Design) and Pulcherrima. Royal Purple is indeed a beautiful plant, in both foliage and flowers. The leaves are purple on the under surfaces and stems are purple. As presently growing, Royal Purple has the larger flowers—nearly two inches across—but this might be attributed to the

fact that it is being grown this year for the first time. A limited number of tubers was available and thus they were not crowded. The others were more or less crowded, which undoubtedly resulted in smaller flower size. The rich purple coloring is identical in all three, as is also the crimson-on-yellow markings at the base of petals.

Achimenes clones Ambrosie Verschaffelt (Figure 2) and Edmund Boissier are so similar that a casual glance will fail to convince one that there is a measurable difference. But certainly no collection is complete

Fig. 4. *xAchimenes* cl. Periwinkle Blue

without one or the other. The stunning venation pattern of these two causes them to stand out, and they are truly in a class apart. The ground color of the petals is a pale yellow, with lavender netting, heavy at the center with lines radiating out to the very edge of the corolla.

Achimenes mexicana (Figure 1), and clones Cattleya, Mauve Queen (Figure 3), Milky Way, Giant Pansy and Periwinkle Blue (Figure 4) might well be placed together in one group as regards flower form and growth pattern. Flowers are large across the face, with tubes usually

shorter than corolla width. All are well suited to basket culture; if grown in pots they cascade over the sides so heavily that pedestals are required to display them at their best.

Achimenes clone Mauve Queen (Figure 3) is the largest-flowering form in my collection. Individual flowers have measured three inches across the corolla. The soft, violet-blue flowers, with crimson-spotted, yellow eyes, makes it a "must-have" indeed. The clones Cattleya and Milky Way are quite alike in flower color, being a pale violet-blue, while the clone Giant Pansy might be called the flower of many blotches. There is a dark blue blotch above the mouth of the tube, with a light cream-colored one below; darker lines radiate out to the edges of the petals. There is no distinct ground color—merely a blending, or merging, of colors ranging from pale lilac to dark blue, but the over-all effect is most pleasing.

Achimenes mexicana is without doubt the most vigorous growing and most floriferous of all *Achimenes* I have grown to date. It is the first to show new top growth, the first to produce flowers (dark blue) and the one that can be depended on to continue abundant flowering throughout the entire season. It may not be the last in flower since some do not start to flower until September; these, of course, will continue to flower after the earlier ones begin to go dormant. Mention was made regarding eating one salted peanut—or growing ONE single variety of *Achimenes*—so it might be stated right here that if you are still timid about investing in ten or twenty or so varieties but are willing to risk a try at one, then by all means order *Achimenes mexicana*. If you fail to become infected by the *Achimenes* "bug" after growing it for one season you are practically hopeless, and you might as well settle on petunias as a substitute.

Achimenes clone Periwinkle Blue (Figure 4) is a delightful subject, in that it is one really "true-blue" among a host of near-blues. This may be a bold statement to make, considering the fact that reference has not been made to any color chart and that my record as a color-classifier is not all that it might be. Even so, it will take anything up to a spectographic examination to convince me that there is something less than a speck of red in many of the so-called blues. Until that time, the clone Periwinkle Blue remains "true-blue" to me.

Achimenes clones Atropurpurea (Figure 5) and Grandiflora are much the same as regards color but there is a distinct difference in growth habit. The clone Atropurpurea (Figure 5) is upright growing, has rather coarse leaves and stems but produces a truly magnificent crop of bright purplish-red flowers. The catalog describes the color as "magenta," but that is incorrect since I do not get the customary reaction. If a certain color starts my eyelids to fluttering and causes me to quiver all over I know positively that it is magenta. So the color of these two is not magenta.

The clone Grandiflora has soft green leaves and purple stems. It might be more correct to say that the leaves are a purple-green; the under-surface is purple and the color bleeds through to create a pleasing combination of green-and-purple. As the stems elongate they tend to cascade over the edge of the pot.

Achimenes longiflora and the clones Dentonia, Andersoni, Galatea and Masterpiece all follow a similar pattern; tubes usually longer than corolla width and flowers in the blue range, varying from the light blue of Dentonia to the very dark blue of Masterpiece. The latter is of upright habit in growth, and is very late flowering. In fact, this is the first year for it to produce satisfactory flowers; the two previous years it had managed to display a few open flowers before going into dormancy but produced no sustained crop. It would seem that an experiment might

Fig. 5. *xAchimenes* cl. Atropurpurea

well be initiated to determine if this variety can be forced to break dormancy in the later winter, in order that earlier plantings be made, to cause the plant to mature by mid-summer. It is handsome in foliage and stems, the former being purple underneath and bronze above, with the stems a showy reddish-purple.

The clone Gauregnia Maxima (probably "Maxima" in the trade) and Dainty Queen (Figure 6) are bracketed together in my notes but in

all fairness to Dainty Queen it should be said that it deserves the spotlight of attention above the former. Gauregnia Maxima is perhaps more free-flowering, and does possess a certain charm over many others in the group, with its white, lavender-centered flowers. A fine lavender line through the center of each petal adds to its distinctiveness. But Dainty Queen has all of this, and more. Flowers are uniformly larger; venation around the mouth of the tube is suggestive of Ambroise Verschaffelt and a heavy, dark lavender line extends through the center of each petal. Both are excellent subjects for basket culture; at least they should be provided with pedestals if grown in fern pots.

The following defy comparison with other plants in this present collection of 36 varieties and species.

Achimenes tubiflora (Hook.) N. L. Britton (syn.—*Gloxinia tubiflora* Hook.) is covered by Dr. Mosher in another article and will not be described in the present article.

Near the top of the list of always-flowering *Achimenes* will be found the clone Venusta. And right inside the greenhouse, beside the entrance door, is a wire basket of this worthy, willing and winsome personality. Foliage color is a dark purple-green and the flowers are a very dark purple. Each flower has additional tiny florets at the mouth of the tube which gives it the distinction of being a "semi-double"; and this, of course, entitles it to placement in a special category. And to realize that this variety was introduced as a new hybrid one hundred and one years ago certainly does not detract from its interest.

Actual placement of flowers on the stems of *Achimenes* plants follows a fairly regular pattern. Usually they appear singly or in pairs from the leaf axils; occasionally there will be three—and very rarely there will be four—emanating from one axil. Flowering is also more or less progressive, opening at the bottom on the first-matured shoots and thence upwards as the shoots mature. One exception to this pattern is the clone Camille Borzoni. Here the flowering buds appear on long spurs arising from the leaf axils. Not just a few buds but literally dozens of them in a cluster. As many as six or more flowers open at a time in each cluster, each flower perfectly in line with its immediate mates yet each group of flowers facing in a different direction. The over-all effect is that of a many-faceted gem. And "Gem" is a worthy title for this little prize. Perhaps "Little Gem" would be more appropriate, since it is diminutive in stature and flower size. It seems to prefer a little support in order to reach the height of fifteen inches it apparently aimed for, but it will be interesting to force it to cascade over the edge of next year's pot. The leaves are rather large for so small a plant but this fact in no wise detracts from the appearance; the flowers practically hide the foliage so one scarcely notices the size of leaf. Flowers are about three-quarters of an inch across and of an unusual lilac tint with golden throat flecked with brown dots. It's new (to me) and has jumped to the top of the list.

Competition for placement at the "top of the list" must be a terrific ordeal for my ambitious plants, so to pacify them it is necessary to

provide for flexibility by setting up various categories. These have now grown to a near dozen—and if anyone ever suggests that a decision be made in favor of any one over the others I shall positively refuse to make a commitment. And so another champion is presented for approval: Master Ingram. This, quite obviously, is a product of English hybridization, since it seems to be the custom in England to call the young hopeful of the Ingram family "Master." Regardless of the derivation of the name, the plant is outstandingly conspicuous on two counts. The leaves are sharply serrated; so much so that it can readily be identified at any growth stage by leaves alone. The second quality to qualify it for top billing (category 3) is the abundance of velvety, carmine-red flowers.

Fig. 6. *xAchimenes* cl. DAINTY QUEEN

And it is basket type, par excellence. This year the "basket" is a spin-dryer from an "Easy" washing machine. I didn't know it at the time but when I found it, out on the back lawn, it seemed to be just the answer to my hunt for a suitable container: round and deep and chock full of nice round holes for the *Achimenes* to poke their little noses through. So I planted the thing to Master Ingram.

Two days later came Monday. Which is also wash day. So I dug up $5.39 and bought my wife a new spin dryer for her "Easy." And it wasn't too easy to avoid her the rest of the week. How was I to know it was part of a washing machine? (Tip to husbands: Bee-ware! Go make yourself a hanging basket and keep hands off any gadget you find lying on the back lawn.)

Aside from the rather high cost, the basket has paid off in a wealth of plant growth and flowers, and present indications are that flowering

may continue well into October. Which should also mean there will be a skillion tubers, more or less, for planting baskets next year. But all of them will be un-''Easy'' baskets from now on.

Pink is displayed by but one representative, Little Beauty. It certainly makes a vigorous attempt to court attention—and receives plenty, what with its shiny, purplish-green foliage, purple stems and lovely rose-pink flowers. Of upright habit; small in stature, with one-and-one-half-inch flowers.

The clone Vivid (= crimson lake in color?) is well named, with vivid, crimson-red flowers so suggestive of *Bougainvillea* clone Crimson Lake. At its best when allowed to cascade over the pot or through the meshes of a wire basket. This variety seems so much more sprightly than the clone Smoky Red, which has flowers of a dull, purple-red.

The clone Lavender Queen is truly a queen, with a spectacular display of large, Gloxinia-like flowers of dark lavender. Foliage is a soft, velvety-green and the plant is upright growing. One disappointment is in the length—or rather lack of it—of flowering period, as it produces one enormous set of flowers early in the season, but by mid-July is so barren of flowers that it is relegated to the ''dormant'' section in the lathhouse.

The clone Margarita is a lovely, if temperamental, individual. Since it is the ''white sheep'' of this otherwise-dark-flowering group it may have acquired a prima donna complex; at any rate, it demands—and deserves—special treatment. Cascade treatment is indicated for attention-getting display.

A final grouping may be permissible for the inclusion of small-flowering forms. These are not considered at the bottom of the list by design; mere size of flower, as such, is indeed a faithless yardstick for calculating the virtues of many a flower. And so the clone Loveliness parades by, saucily saying ''sure, I'm tiny; but see how multitudinous I am.'' That's a big word for a little flower but it is the truth. If one were to take the area of this pee-wee, violet-faced flower, multiply it by the number of flowers on the plant, and then compare it with the total area of many of the larger-flowering forms the result would be surprisingly in favor of Loveliness.

Achimenes pulchella is another midget-flowering species. Bright, orange-red little fellows that just seem to be smiling all the time. *Achimenes patens* var. *major* is also in this group, with color too close to magenta for my eye comfort.

Several more varieties remain to be described, but because of lack of distinguishing characteristics, or close resemblance to already-mentioned forms, it would be pointless to devote further attention to them here.

It is impossible to conclude this piece without expressing the hope that you have discovered, after reading this far, that *Achimenes* growing can be a lot of fun, and that you can derive real joy and satisfaction from their association.

THE **ACHIMENES** COME BACK

WYNDHAM HAYWARD, *Florida*

At long last, the dainty and charming, unobtrusive yet gay and colorful *Achimenes,* a popular greenhouse and conservatory plant of the last century, is coming back to take its place again, at least in the half-shade, if not the sun.

For *Achimenes* cannot stand three things—drought, strong sunlight and cold. Possibly strong wind or draughts should be added to these don'ts for these lovely little plants which are grown from the most curious little tubercles, catkin-like affairs, resembling miniature pine cones in some species and almost wormlike in appearance in others.

The genus *Achimenes,* which has given rise to the modern hybrids, includes a few interesting species from more or less tropical America, as *A. longiflora, A. multiflora, A. tubiflora, A. hirsuta* and *A. grandiflora,* among others. The name comes from a Greek word meaning to suffer from cold, and this certainly describes the *Achimenes* plant, as several clones were slightly ''scorched'' by cold during the early stages of their growth last spring at Lakemont Gardens in Winter Park, Florida, when the thermometer unexpectedly went down to 40 degrees in late April. They quickly recovered in the warm days that followed.

In other words, *Achimenes* should have a warm, moist atmosphere, airy but part shade. They are members of the *Gesneriaceae,* that varied and ever more popular group of herbaceous and tuberous rooted plants including the ubiquitous *Saintpaulia,* which is riding high on the wave of current plant faddism at the present time. Actually with no disparagement intended toward the *Saintpaulia,* the *Achimenes* offers much greater interest and beauty in the variety of color shades, shapes and textures of bloom and foliage than the saintpaulias possibly could have. The achimenes also go dormant in winter, which makes their care in half of the year much more simple than that of saintpaulias.

Fundamental directions for the growing of achimenes would include the planting of four or five tubercles in late winter or early spring in a 5 or 6 inch pot. Actually a well grown plant from a single strong achimenes tubercle will well take care of a five-inch pot, but nevertheless a fuller and more shapely appearance is obtained by the planting of several tubercles. The soil should be a light, friable, leaf mold, sandy loam, clean of nematodes or other pests, in other words a soil such as might be dug up in the woods under an old oak tree, far from habitations. A little well-rotted cow manure may be added and some sand to make it porous if the humus content is too heavy.

There should be good drainage in the pot, a crock over the hole and a handful of granite or other non-calcareous gravel or rock or broken crocks, pieces of pot, etc., in the bottom. The writer puts a handful or large wad of fibre, as Spanish Moss (*Tillandsia usneoides*) in the bottom of his containers (gallon cans being sometimes used in commercial culti-

vation), then three or four inches of the prepared sifted potting mixture (which may include some slight amount of garden loam and a little sifted carex peat) on top of the drainage, and finally the tubercles are planted flat on this soil and covered with half to one inch more of soil, firmed well. The pots are placed in the shade for careful watering.

The matter of shade for Achimenes is strictly relative. They are cared for like gloxinias and saintpaulias. Strong sunlight must not strike the leaves while these are wet, or burning will result. Therefore watering should be done with a fine spray late in the afternoon after the sun is low.

When this is done, and the plants are maintained in sufficient warmth, there will be no damage to foliage from watering even under lath shade. The writer would say that house temperature of 68 degrees would be a satisfactory minimum for achimenes. They like it even warmer in Florida, where they are grown at Lakemont Gardens in a lathhouse with 50 per cent shade, with perfect success. The flowers last longer and have better color when the plants are grown on a porch or under an oak tree giving plenty of light from the side, but almost complete shade above.

Hanging baskets as are used for gloxinias and tuberous rooted begonias are excellent for achimenes, and should be lined with a layer of damp sphagnum moss before placing the potting soil inside. The drainage in this kind of container is more perfect than in anything else. The plants also dry off quicker than in pots and watering must be regular and thorough. The achimenes will stand a few drying-out periods without too much harm, but continued neglect will result in unsightly, damaged plants and loss of propagating tubercles.

Achimenes range from the pure white Margarita, also known as Purity, which is just about an albino type. It is the only known pure white in the *A. longiflora* group, which is one of the leading classes of the achimenes and our own personal favorites. Others in this group are *Achimenes mexicana, A longiflora* var. *major,* sometimes called Magnificum, and the clones Denninii, Galatea, Cattleya, Pink Beauty, etc. These are early to midseason flowering types.

Then there is a still earlier flowering group featured by a purple variety variously called Purple King, Royal Purple, Pulcherrima, with slight variations of foliage and flower tints. This, and Galatea mentioned above, are probably the easiest and most colorful achimenes and the earliest to flower for showy summer bloom. Some of the other clones bloom late in summer, even into fall, as Little Beauty, a lovely salmon pink, *A. pulchella,* Loveliness, etc.

There is a striking mid- to late-season lavender-rose clone called Vivid, which is growing in popularity in America and Holland at this time. It has other names in the trade, since nomenclature in achimenes like the camellias is badly confused. A few varieties can be readily identified, but most of them appear under several names when obtained from various sources.

America, Holland and India are the main growing centers of

achimenes at this time. Nurseries in India list the largest number of named varieties, and the tubercles can be imported by airmail with United States Department of Agriculture permits. The Holland firm of Messrs. C. G. Van Tubergen has one of the best lists of achimenes varieties in Europe. Before World War II such British firms as Sutton's and John Peed carried choice collections. In the United States there are several of the mail order bulb dealers offering achimenes among their choice bulbs and tubers for summer pot plant use.

The achimenes are hairy herbs growing a foot or more tall, with attractive foliage and bearing abundant flowers, sometimes enough fairly to hide the foliage, over a period of many weeks. Colors range from pure white to deep purple, with many shades of red, crimson, yellow-lavender, rose, purple, lavender, blue, etc. The red and lighter pastel shades are more unusual, especially in the large flowered types. Largest flowered varieties to the writer's best knowledge are found in the *A. longiflora* section such as Dainty Queen, a pure creamy white with light lavender spot at throat, which is sensational in a well grown pot. *A. longiflora major,* known as Magnificum, is even larger, up to three inches across the flower in the best specimens, but the flowers are not as abundant as in the smaller types.

After the plants have bloomed the watering should be decreased, and in a few weeks the plants will go to rest naturally. The tubercles can be dried off in their pots or containers and stored in a moderately cool atmosphere like a root cellar, dry but not too close, during the winter. Some of the nurseries have the tubercles ready to ship in late October. The tubercles may be removed from the soil carefully by sifting when thoroughly dried out in late fall, and stored in a fine grade of vermiculite, sifted dry peat or dry fine sand in boxes until early spring. Storage temperatures should not go below 50 or 55° F.

By starting several lots in the spring, a week or two apart, they can be had in a succession of bloom. The late blooming varieties should be started early so that they may be in bloom by late summer, August or September. These include primarily Maduna, *A. pulchella* and Loveliness, as now grown in this country.

Achimenes tubiflora is a striking plant, more like a *Gesneria* than an *Achimenes,* having bright green woolly foliage, long white blooms in an ascending spike, all in the same plane, and bearing tubers more like the gesnerias, potato-like, sometimes as big as an egg. This seems doubtfully to belong in the *Achimenes.*

Hybridizers have almost unlimited possibilities in the achimenes, but their work will need all the care and assiduous attention that the breeding of begonias and saintpaulias demands for success. Seeds are tiny, dust-like particles and can be grown like begonias and gloxinias. Hybridizing the achimenes will be a more delicate task than in the case of most plants. But the enormous variety of types and colors already available practically assures some kind of interesting results. There are too many purples, lavenders and mauves among the popular varieties. More than half are in this range. Yet there are some lovely blues, whites and a few good reds, but no large clear reds or rose varieties that the writer has

seen. *Achimenes pulchella* is a fiery red but tiny, less than half an inch in diameter.

Besides seed, the achimenes has all of the disversified propagating character of the gesneriads. A. A. Longmire of Carpenteria, Calif., has published a pamphlet on *Gesneriaceae* propagation which will be helpful to any beginner with the plants. Briefly, the achimenes tubercles can be cut into sections and will produce several to many plants from one tubercle. The writer uses a sharp safety razor blade for this, slicing the tubercle just as one would slice a piece of bologna in miniature. If the sections are not thinner than 1/16 of an inch, they seem to grow all right in sterile soil, thinly covered, kept moist, shaded and warm. Of course pieces like this do not produce such strong plants for flowering purposes the first season, but this is not important where propagation increase is the need.

Achimenes are also propagated from stem cuttings, tip cuttings, leaf cuttings, leaf sections, etc., rooted in clean white sand or mixed sifted peat and sand, with shade and careful watering. One might conceivably obtain 100 plants or many more from a single tubercle in a season.

[GESNERIACEAE AS A HOBBY—The Moshers,
continued from page 28.]

signs of growth in the early spring shake them carefully from the soil and repot as noted above.

When watering use care as for rex begonias. Do not wet the leaves with hard water as the deposit left upon evaporation will stain them.

A number of varieties have been developed by European specialists. The best now available in this country are Orange Delight, Monarch and Rose Queen which all have beautiful flowers and foliage.

If you are looking for a group of plants which give of their beauty over a very long period, be sure to try the Hybrid Naegelias.

CESNERIACEAE AS A HOBBY

THE MOSHERS[1], *Washington*

I. ACHIMENES

Writing of *Achimenes* as a hobby is a difficult subject because different people would find pleasure in widely different phases of any subject, consequently we will only indicate some of the phases of achimenes culture which have proved of special interest to us in the hope that others may find fields to explore on their own.

This group first attracted our attention just before the war when a friend gave us a pot of *Achimenes* clone Purple King in full bloom. Immediately they became a challenge to us. We resolved to obtain other clones and to find out more about them. During the war years achimenes tubers were difficult to obtain, but by searching through old gardens and plant collections, we obtained a number of the best varieties obtainable in this country.

Since the war we have continued to collect clones from all over the world. Achimenes tubers, unlike many other tubers, resent dry storage and can not be shipped long distances without serious loss. Many of our anticipated shipments were received with every tuber entirely lifeless. However, by trying again and again, we have built up a collection of the finest varieties in existence in the world today.

Elsewhere in this issue descriptions of varieties and cultural notes for the Achimenes are given in some detail. Like most garden flowers, many clones are relatively tolerant of a wide range of conditions. However, some clones are more demanding and offer a challenge to the hobbyist. Some of the rarer European clones in particular have not bloomed for us as yet. The flowering of these is a goal to be attained perhaps through the use of heat or special soil, etc.

Most of the clones now in existence were developed many years ago in Europe and England. There is a fertile field in the production of new ones, especially by hybridizing them, if possible, with the related plants such as the Isolomas, Naegelias, and other Gesneriads. The production of seed on the Achimenes offers a challenge to the grower. We have made hundreds of hand pollenations, but have never had any seed form on the hybrid clones. Perhaps a different method of handling the pollen must be discovered. Most of the flowers appear to be sterile of pollen, but this is not the case as the pollen falls from the anthers soon after the flower opens.

The Achimenes species are all native of tropical America and were grown, as were the hybrid clones, by European and English gardeners in warm or stove houses until about the time of the first World War. Then in order to save their choice plants, as fuel became limited, they tried them in cool and unheated houses. However, for seed production more heat or humidity may be required during certain stages of their development.

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[1]Dr. Kenneth H. Mosher and his wife, of Seattle, Washington.

The use of drugs such as colchicine, or other treatment of the plants may be required to induce seed formation.

Such problems as these lend themselves especially well to the hobbyist. A person planning to start with a few clones would do well to obtain a few tubers of some of the following which are among our own favorites. Then as they come into flower, the gardener can enlarge his collection according to his personal preferences.

Foolproof clones that will grow and flower under adverse conditions: Purple King, rich velvety purple; Edmund Boissier, white background with purple markings; and Madame Gehune, purple with white throat, large beautifully veined leaves.

Relatively foolproof varieties: Master Ingram, bright true red; Little Beauty, true pink, compact growth; Giant Pansy, large flat flower of blue, yellow and white on a hanging basket plant.

Beautiful foliage types: Maduna, lavender with white throat; Stormcloud, purple tubular flowers with a white throat, large velvety green leaves like a Tydaea.

Small flowered type: Loveliness, rich velvety red-purple; *A. pulchella,* small bright fiery red; Camille Brozzoni, lilac with a white throat.

Achimenes Tubiflora, a species with tall flowering stems bearing clusters of pure white tubular flowers with a delicious fragrance. We consider this one of the finest plants in the whole *Gesneriaceae.*

In writing of the Achimenes it is very difficult to leave out of the discussion the closely related groups such as the Isolomas, the Hybrid Tydeaes, Naegelias, Kohlerias, Gesnerias, etc. These all respond to the same treatment as the Achimenes, and in many cases will hybridize with them. Each has its own characters, but all are blended so subtly together that they are really just one big group horticulturally.

In choosing a plant hobby each person will be influenced by different considerations; some may be searching for a group of great beauty, others for something rare or difficult to grow, others something easy, etc. But whatever it may be the Achimenes group offers the gardener a satisfying experience.

II. ACHIMENES TUBIFLORA

This plant was introduced to England from Buenos Aires in the 1840's and named *Gloxinia tubiflora* Hook. (Bot. Mag. Lond. pl. 3971. 1843). The combination *Dolichodeira tubiflora* (Hook.) Hanst. (Linnaea 26:205. 1853-55) was later made. We know it now as *Achimenes tubiflora* (Hook.) N. L. Britton (Ann. N. Y. Acad. Sci. 7:185. 1893.) However, the characters of the plant and flowering habit are definitely not Achimenes-like. The flowers resemble those of a typical *Achimenes,* but no more than the flowers of many other genera which have been separated from *Achimenes* such as the Tydaeas, Isolomas, and Naegelias.

Achimenes tubiflora has long, tubular, pure white, fragrant flowers borne in clusters at the top of a tall flowering stalk often 18 to 36 inches high. The leaves are large, velvety green, opposite, oblong, and reticulated. The tubers are like potatoes, bearing no resemblance to the typical

Achimenes rhizome. In our opinion, the name *Dolichoderia tubiflora* would be much more appropriate for this plant than the one now accepted.

However, whether Dolichoderia, Achimenes, or Gloxinia this is a truly wonderful plant growing with the same care as tuberous begonias. Blooming in the summer, and suited for the outdoor garden in most localities, the fragrant flowers scent the whole neighborhood with a pleasant tropical fragrance. The flowers are also fine for cutting, if desired.

Achimenes tubiflora is a plant worthy of much wider cultivation.

III. KOHLERIA PICTA

Perhaps the name of no other garden flower is in such a state of confusion as is that of *Kohleria picta.* The mix-up of nomenclature here is more or less typical of that of many of the Gesneriads, and serves to bring home the necessity of an immediate and thorough revision of the whole *Gesneriaceae.*

Kohleria picta was first introduced from Mexico to England in 1843 by Theodore Hartweg and classified by Bentham as *Achimenes picta.* Under this very appropriate name it flourished in English gardens for many years. When discovered and examined by the Continental European botanists a few years later, it was first described by Regel in "Flora" in April 1848 as *Kohleria picta.* Later in the same year Decaisne in "Revue Horticole" founded the genus *Tydaea* on this plant, calling it *Tydaea picta.* Decaisne also founded the genus *Isoloma* at the same time, taking the name from Bentham who had used it as the name for a section of the *Gesneraceae* in setting up the family and genus in his Genus Plantarium. A few years later *Tydaea* was included in *Isoloma.* Consequently the plant should become *Isoloma picta;* however, there already was a plant known as *Isoloma pictum,* and a new name was developed—*Isoloma bogotense.* Under this name the plant has struggled to maintain itself.

Based on the present rules of priority in nomenclature, *Kohleria picta* is the name that should be reaffirmed for this beautiful plant. The Continental European authorities have adopted this name, and we in this country should do the same.

Kohleria picta is a very satisfactory plant growing from a long, brown, furry, caterpillar-like rhizome. The plants should be handled exactly like Achimenes except that they need more room. We had good results with them in gallon cans and large pots. The plants grow one to two feet tall. The leaves are large, mottled brown, and covered with velvety hairs. The flowers are borne on peduncles from the leaf axils, often many open at once. They are tubular, orange-red and yellow, the lower lobes of the tube being red spotted on the yellow (from whence the name picta—spotted). They bloom over a long period of time.

A pot of this plant in full bloom is a sight never to be forgotten. Try it.

IV. HYBRID NAEGELIAS

Naegelias are Gesneriads closely related to the Achimenes and Isolomas. They have been developed chiefly in Europe over a period of about 100 years through extensive hybridization of the species such as *Naegelia zebrina* and *N. multiflora;* and by crossing them with *Achimenes* and *Isoloma* and related plants. This group of flowers includes some of the finest pot plants in existence. They are foliage plants rivalling and even surpassing the Rex Begonias and Fancy-leaf Caladiums, having large heart-shaped leaves of rich green, mottled and veined with rich chocolate brown. The leaves and stems are covered with velvety hairs which in some varieties appear green when viewed from certain angles, and red when viewed from others.

Late in the summer large clusters of beautiful tubular flowers develop from the axils of the upper leaves and the terminal bud. The flowers are somewhat Achimenes-like with the limb of the corolla less expanded, and more tubular, usually in shades of red, yellow and orange, often heavily spotted inside the tube. A number of flowers open at once and remain in good condition over a long period of time. By maintaining a uniform temperature after the plants come into bloom, they can be had in bloom at Thanksgiving or even Christmas. For the window garden or cool greenhouse they provide a wealth of color when flowers are hard to find.

The tubers or scaley rhizomes resemble some of the larger Achimenes tubers, but are more like small pine cones. Pot them up singly in 4 or 5 inch pots or quart cans immediately upon obtaining them, using a light rich compost containing leaf-mold, peat-moss, or vermiculite, but no manure. Place the potted tubers in a position where they will be free from frost until March or April, when they should be moved to a position where the temperature will be betwen 50 and 60 degrees at night. A light basement, garage, window garden or greenhouse bench should provide the satisfactory conditions needed to start them and maintain early growth. Water only sparingly until the growth appears above the soil, then top-dress with well rotted manure and keep moist while in full growth. Applications of weak manure water from time to time should be given until the flowers open. Normal summer temperatures will maintain full summer growth. Late in the summer move them to a spot where the temperatures will not fall much below 45 degrees in order to extend the flowering season. When the plants indicate by yellowing or withering leaves that they are through growth for the year, withhold water and when they are entirely dried off, remove the stems at the soil level and store the entire pot in a frost-free place in the garage, basement or under the greenhouse bench. Inspect the pots from time to time during the winter and sprinkle lightly if the soil appears too dry. Never store the rhizomes out of soil or vermiculite, and preferably do not disturb them in the pot until time for repotting in the spring. When the tubers show

[GESNERIACEAE AS A HOBBY—The Moshers,
continued on page 24.]

PLANT LIFE, VOL. 5, NO. 4, OCT. 1949

HERBERTIA

1949

AUSTRALIAN EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

[CORRIGENDA: AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub & Moldenke. Continued from page 32.]

Page 154, under Description of subgenera and species, 2nd line, change "Specias" to "Species."
Page 164, under "Range.—," 2nd line, change "Maximowcz" to "Maximowicz."
Page 165, 3rd line of text from top, change "Regal" to "Regel."
Page 169, under Description of subgenera and species, 7th line, change "*sanguinae*" to "*sanguinea.*"
Page 177, 3rd line from top, change "segments" to "segmentis."
Page 183, 21st line from bottom, change "1939" to "1929."
8th line from bottom, change "1873-85" to "1783-85."
Page 184, 5th line from bottom, change "Wright" to "Wright Smith."
Under Stapf, O., change "pl. 9152 to "pl. 9162."
Page 185, under Perigone, change "flora" to "floral."
Page 186, 21st line from top, after "*Amaryllis elegans*" change "Lam." to "Sprengel."
Page 187, under "AMARYLLIS Herb.," "*belladonna* Herb.," add "61," and change "67" to "66"; also, under "*belladonna* Herb." add "*blanda,* 61," and "*pallida,* 61."
Page 193, first column, under "*Roezli,* 186" insert "*roseum,* 97."

NOTE.—Any additional corrigenda for this publication will be included in the following numbers of Herbertia.

PREFACE

PLANT LIFE, vol. 5, no. 4, the 1949 HERBERTIA number, is the 1ST AUSTRALIAN EDITION OF HERBERTIA. It is dedicated to Capt. Charles Osborne Fairbairn, an outstanding Australian amaryllid breeder, who specializes in *Narcissus*. In recognition of his achievements, the 1949 HERBERT MEDAL has been awarded to him. Capt. Fairbairn contributes an interesting autobiography to this issue of HERBERTIA.

Australian horticulture has suffered very great losses in 1949 in the deaths of four pioneers. It is with the deepest regret that we record the passing of Alister Clark, 1864–1949, William Jackson, 1865–1949, Charles Alfred Nethercote, 18??–1949, and C. E. Radcliff, 18??–1949. Brief In Memoriam notices are included in the present issue.

Thanks are due Mr. Fred M. Danks, Corresponding Fellow in Australia, who handled the details for the Australian papers appearing in this issue. Without his inspiring personality, this 1ST AUSTRALIAN EDITION could not have been achieved at this time.

Mr. Danks contributes an interesting note on "Horticulture in Australia." Other Australian articles include "Australian Amaryllids" by J. H. Willis, "Hybrid Amaryllis Breeding in South Australia" by E. Both and "Daylilies in Australia" by Fred M. Danks.

There is also a wealth of other interesting articles in this issue, in addition to the articles already mentioned. There are *Hemerocallis* articles by Elmer A. Claar (Ann. Report), Grafton W. Shults (daylily breeding), George Gilmer (distant shipping), Philip G. Corliss, M.D. (new daylilies); and descriptions of new daylilies. There are articles on hybrid *Amaryllis* by Mrs. W. D. Morton Jr., Cecil Houdyshel; and an article on a new pink *Amaryllis* by Mrs. Mary G. Henry. *Narcissus* articles are contributed by Grant E. Mittsch, Dr. J. S. Cooley, and W. R. Ballard. There are also articles on various amaryllids by Dr. Gouws, Messrs. Woefle, and Hinman, and Mrs. Coombs.

The 1950 HERBERTIA number is to be the HYBRID AMARYLLIS EDITION, and it is to be dedicated to Mrs. Mary G. Henry. Most of the articles for this issue have already been received, and it is scheduled for publication early in 1950.

—*Hamilton P. Traub*
Harold N. Moldenke

November 1, 1949

CORRIGENDA

HERBERTIA, VOL. 15 (1948) 1949

Page 51, 3rd paragraph, 3rd line, change "42nd Ave." to "40th Place."
Page 158, 13th line from bottom, for "*multiflora*" read "*hybrida.*"
Page 159, Fig. 209, change "*rosea*" to "*hybrida.*"
Page 165, after "Mr. Henry H. Nehrling, *Fla.*" insert "Mr. Theodore L. Mead, *Fla.*"

AMARYLLIDACEAE: TRIBE AMARYLIEAE, BY TRAUB & MOLDENKE 1949

Page 5, 21st line from bottom, change "*Cytanthus*" to "*Cyrtanthus.*"
Page 14, 2nd line, change "ganus" to "genus."
Page 26, 1st line from top, change "lectrotype" to "lectotype."
2nd paragraph, 5th line, for "Wright" read "Wright Smith."
Page 29, 3rd line from bottom, for "Farm." read "Farn."
15th line from bottom, delete "capitate obscurely."
Page 30, 3rd line from top, change "13" to "16(19?)."
4th & 5th lines, change "5-flowered" to "8-flowered."
Page 33, 13th line from bottom, change "Linean" to "Linnean."
Page 44, 19th line from top, change "Specias" to "Species."
Page 47, 5th line from top, change "includes" to "include."
6th line from top, change "it" to "them."
12th line from top, change "Planarum" to "Plantarum."
20th line from top, change "Wright" to "Wright Smith."
Page 55, 1st column, 3rd paragraph, 2nd line, change "El." to "Ed."
Page 66, 3rd paragraph, 8th and 9th lines, delete "capitate" and change "obscurely trilobed to rounded" to "trilobed to capitate."
Page 74, 16th line from top, change "conclusion" to "conclusions."
Page 75, 2nd paragraph, 13th line, change "Wright" to "Wright Smith."
Page 85, Table 6, change "*A. abvena*" to "*A. advena.*"
Page 90, 17th line from bottom, change "*Amaryllis flavus*" to "*Amaryllis Solisii.*"
Page 94, 2nd line from bottom, change "*pumila*" to "*Barlowii.*"
Page 113, 11th line from bottom, change "2.5–3 cm." to "2.5–3 dm."
Page 115, 3rd line from bottom, delete "Syn."
7th line from bottom, change "16" to "359."
Page 124, 2nd line from bottom, for "1937" read "1837."
Page 128, 10th line from bottom, change "253" to "353."
Page 129, 3rd and 4th lines from top, transfer "*H*[*ippeastrum*] *Tweedianum* Herb., Amaryll. 425 [Index]. 1837." to the synonomy of *Amaryllis elegans* Sprengel, on page 109.
Page 133, 6th line from top, change "*taeniopohylla*" to "*taeniophylla.*"
Page 139, after "*Amaryllis ciliaris* Linn., Sp.," insert "Pl."

[CORRIGENDA: AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub & Moldenke. Continued on page 30.]

Dedicated to

Capt. Charles Osborne Fairbairn

Herbert Medalist—Charles Osborne Fairbairn

Plate 1

CHARLES OSBORNE FAIRBAIRN, O.B.E., A.F.C.[1]

An autobiographical sketch

I was born in Victoria, Aust., 1893, into a family now having over 110 years of pastoral experience in Australia, and was educated at Geelong Grammar School and Cambridge University, from where I joined the Royal Flying Corps at the beginning of the first world war. I was wounded in action and awarded the Air Force Cross. Returning to Australia after the cessation of hostilities, I took over the management of "Banongill" upon my father's retirement. This engaged my full attention until the outbreak of the second World War, shortly after which I was appointed to command the R.A.A.F. air crew training establishment at Ballarat, Vic., receiving my discharge in October 1944 with the rank of Group Captain, and was appointed an Officer of the British Empire.

In addition to managing this property the family love of horticulture persisted. When the local Postmaster suggested organizing a daffodil show, as this district is very well suited for their cultivation, I readily agreed. The exhibit that we staged was a very sorry sight beside the exhibits of those renowned growers Leonard Buckland and West and Fell. However, it roused my Scottish pigheadedness and I became determined to grow blooms that could hold their own with the best. Thus started 27 years of intensive culture of Daffodils. I procured some up to date bulbs from Mr. Leonard Buckland and continued to import the best that I could get from England, Ireland, Holland, New Zealand and Tasmania, besides many local ones. At the same time I started to raise my own seedlings. As I was already a breeder of thoroughbred horses, sheep, cattle and dogs I realized the benefit of keeping ample and accurate records and of course already had a working knowledge of the Mendelian principles of heredity.

My early efforts were chiefly directed towards improving the color of the red and yellow varieties and later towards their resistance to burning by the sun. At no time would I tolerate any that were not strong stemmed and of good habit in the garden. Later my efforts were directed towards all varieties of daffodil but now the pink, and red and white, varieties are getting most attention and again my objective is to improve the color, garden habit, and resistance to sun.

Though I am not very interested in exhibiting, I do so occasionally to see how my introductions compare with those of other hybridists.

It has given me great satisfaction to win the principal Seedling awards both in Victoria and Tasmania, the only two states in which I have competed. But it gives me still more satisfaction to hear growers say how well this or that variety of my raising does in the garden. It has also given me great satisfaction to see the Skipton Show, so humbly started, rise to one where the average standard of bloom is second to none in the state.

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[1]The 1949 William Herbert Medal was awarded to Mr. Charles Osborne Fairbairn for his outstanding achievements in Narcissus breeding.—*Editor.*

Another activity that is occupying some of my time now is experimenting with imported bulbs from England to see which is the best way to get them acclimatized. Some of the results have been surprising but the early impression is that different varieties need very differnt handling.

My other recreations are Golf, Tennis, and Horse Racing including the breeding of horses.

NARCISSUS LEGACY OF CLARK, RADCLIFF, NETHERCOTE AND JACKSON

Harold Alston and J. R. Byfield

The year 1949 has been marked by the passing of four of the most noted raisers of narcissi in the Commonwealth. The deaths of Messrs. Alister Clark, C. E. Radcliff, C. A. Nethercote and Wm. Jackson are mourned by all lovers of the Daffodil and have left a blank in the list of pioneer hybridists which it will be difficult to fill. All four played an important part in establishing the cult of the *Narcissus* in the Antipodes and have left a wonderful legacy of fine flowers for the younger generation to carry on with.

—*Harold Alston*

IN MEMORIAM—ALISTER CLARK, 1864-1949

Mr. Alister Clark, B.A.F.R.H.S., was the doyen of the cult in Victoria. His death, which occurred at his home, "Glenara," Bulla, Victoria, on January 20, 1949, removed from Australian Horticulture one of its greatest and best beloved personalities. Born at "Glenara," Bulla, where he lived all his life, he was within a few days of attaining his 85th birthday. Though born in Victoria, he spent a portion of his school days in Tasmania, New South Wales and Great Britain, and graduated Bachelor of Arts at Cambridge University. A personal friend of Mr. Andrew Kingsmill, he became interested in the Daffodil and through him he and his brother-in-law, Sir Heaton Rhodes of "Otahuna," New Zealand, became members of a syndicate, which included Miss Helen Willmott and Mr. J. T. Bennet Poe, to acquire the stocks of the earliest productions of the Rev. G. H. Engleheart. This was in 1897 and among the bulbs secured were: White Queen, Albatross, Noble, Lemon Queen, Solfaterre, Amber, Valeria, Astrardente, Zenith, Bianca and Diana. In the following year, Mr. Geo. S. Titheridge on his return to England disposed of his large collection of bulbs and Mr. Clark and the late Mr. Leonard Buckland of Camperdown, Victoria, secured the bulk of his collection. This was the beginning of half a century of sustained and enthusiastic cross-pollination and the production of new varieties from seed. Among his first and most notable productions were: Felucca, Nulli Secundus, Colonel Bogey, Sunshade, Footlight, Daydream, Firebell, Isolde, Lady Northcote and Betty McMullen. Using *N. triandrus* var. *albus* and *N. jonquilla*, he produced many charming hybrids. His Triandrus hybrid,

"Nightlight," is probably one of the whitest flowers in cultivation. About 1914, however, an epidemic of eel-worm played havoc with stocks at "Glenara" and for some years Mr. Clark had only healthy seedlings of his own raising with which to work, and in this respect his work was remarkably successful. Always fond of flowers of the Leedsii type, he produced many attractive flowers, many of which had buff edges to the corona. About 35 years ago, however, his production of a daffodil with

Fig. 7. Alister Clark, 1864-1949

pink corona opened up new vistas on the production of flowers with pink or pink-edged crowns. Notable pink varieties raised by him include: Mabel Taylor, Promisso, First Blush, Madge Buckland, Better Half, Mrs. Alister Clark, and Hugh Dettman, and there are still many more as yet un-named. For many years he, together with the late Messrs. L. Buckland and D. V. West, were keen competitors in the larger classes at the Royal Horticultural Society's and other shows, and in addition his non-competitive displays of seedlings of his own raising created intense in-

terest and stimulated other growers in the raising of seedlings. His award of the Peter Barr Memorial Cup was a well-merited tribute to his work as he may truly be said to have placed Daffodil culture in Victoria on a sound and stable basis and has enriched the gardens of the Commonwealth with many charming flowers. In addition to his work with the Daffodil, he had of recent years interested himself in the production of Nerines with considerable success, and the award of the Dean Hole Memorial Medal for his work with the rose indicates his wide interest in horticulture. In the production of his daffodils all records and pedigrees were kept with meticulous accuracy, and the hybridizing and cultivation were the personal work of Mr. Clark. Such thoroughness brought its own reward and is evidenced by the number of fine flowers which have been raised at "Glenara." Visitors to "Glenara" received many tokens of his generosity and to those who were privileged to enjoy his friendship and the more intimate association of his home life, and to participate in the work of selecting his seedlings, he was a delightful companion and generous host. To daffodil growers his passing has left a blank which will be hard to fill as his unassuming nature and sincerity endeared him to all who came in contact with him. To his horticultural friends he will remain an enduring memory of a delightful personality. They farewell him as a very great gentleman and a generous and devoted friend.

—Harold Alston

IN MEMORIAM—WILLIAM JACKSON, 1865-1949

The death of Mr. Wm. Jackson on May 22, 1949, in his 83rd year, deprives Tasmania of one of its most esteemed daffodil specialists.

Born in England in 1865, he was educated at Shrewsbury and at Caius College Cambridge, where he studied medicine. Mr. Jackson married in England and arrived in Tasmania in 1898, taking up residence in Dover, then known as Esperance. Mr. and Mrs. Jackson remained in the district for the whole of their lives. They raised a family of three sons and two daughters, all of whom survive their parents.

In all branches of athletics the name of Jackson became a household word in Southern Tasmania. Himself a fine all-round athlete in his youth, Mr. Jackson was a keen supporter and patron of cricket, football, tennis, rifle shooting and yachting. He was many years Warden of Esperance Municipality, Coroner for his district and a special Magistrate.

An acknowledged authority on all branches of horticulture, Mr. Jackson was keenly interested in the raising of daffodil seedlings, commencing serious work about 1924. His efforts met with early success as in the 1928 show one of his seedlings was awarded Champion Bloom honors. In this year the C. E. Webster Challenge Cup competition was inaugurated and is awarded annually to the twelve best seedlings raised in Tasmania. Mr. Jackson scored four wins and was runner-up eight times in this section. During the past twenty years Mr. Jackson has raised many fine seedlings which have won highest awards in strong competition. In the Ajax, Barrii, Leedsii and Incomp. classes he was always

strongly represented and on four occasions won the champion award with blooms of his own raising.

Mr. Jackson's methods as a hybridist were based on accurate recordings of every detail as regards parentage, date of sowing, germination and blooming. In many instances the measurements of the first blooms were recorded. Invariably Mr. Jackson could name the parentage of a flower without reference to pedigree lists.

Of a bright and cheerful disposition, always prominent in all philanthropic movements, together with a genial personality and keen sense of humor, Mr. Jackson was assured of an enthusiastic welcome from all classes of the community. Tasmanians especially feel very keenly the loss they have sustained by his passing.

Many amateur gardeners throughout the State have benefited by Mr. Jackson's generous distribution of his daffodils. He was never known to sell a bulb from his gardens; on the contrary, one had only to display interest in growing daffodils to be promptly offered additions or a collection to start the novice on his way to the show benches.

Mr. Jackson's name will be perpetuated by the gracious action of his family who have donated perpetual Challenge Cups to the leading shows and societies for annual competition.

It is also pleasing to record that one of Mr. Jackson's sons, William, will continue the work to which his father so successfully devoted his skill and enthusiasm.

—J. R. Byfield, President,
Hobart Horticultural Society.

IN MEMORIAM—CHARLES ALFRED NETHERCOTE, 18??-1949

Charles Alfred Nethercote, who died at his home in Victoria on April 30, 1949, was a member of the Royal Horticultural Society of Victoria for fifty-eight years, the past thirty-six of which he was the Society's Treasurer. He was appointed to the Committee on the Amateur side in 1896, and was later made a Life Member for his services.

A contemporary of the late Messrs. Geo. S. Titheridge, Henry Boyce, Walter J. Smith, Alister Clark and Leonard Buckland, he started growing daffodils in 1890 and from that time on was a regular importer of bulbs from Great Britain. In conjunction with his life-long friend the late Mr. Scott Morrison, who had a property at Wandin on Mt. Dandenong, he established a large collection of all the representative types amounting in latter years to an area of approximately twenty-two acres. He was a great friend of the late Mr. Leonard Buckland of Camperdown and stimulated by his success in raising daffodils from seed he commenced hybridizing and produced many fine types, his first and best known success being his Jonquil hybrid, Gertrude Nethercote. Other varieties raised by him were: Tanjil, Clunes, Abcal, Bunnies and several cyclamineus hybrids.

He had an encyclopedic knowledge of varieties both old and new and their origin, and was considered the finest judge of the flower in

the State. In addition to raising many flowers of exhibition type he was keenly interested in species and miniature types and used *Narcissus triandrus, N. calathinus* and *N. cyclamineus* freely. He was of a most unassuming nature, of the highest integrity and most generous—many beginners receiving parcels of bulbs suitable for laying the foundation of a good collection. He was in his 83rd year and is survived by a son and daughter, his wife having predeceased him some years ago.

—*Harold Alston*

IN MEMORIAM—C. E. RADCLIFF, 18??-1949

I.

The untimely passing of Mr. C. E. Radcliff, District Surveyor of Hobart, Tasmania, removes from our midst one of the most prominent raisers of seedling daffodils in recent years. He was the first Australian grower to be awarded the Peter Barr Memorial Gold Cup by the National Daffodil Society of England. The award was made in 1946 for his outstanding work in the production of pink cupped seedlings. Several of Mr. Radcliff's pink daffodils have been distributed in England and the United States. One noted seedling—Rosario—being catalogued in Ireland at £10; another notable flower, Moina, a pink crowned Leedsii, was the first Australian raised daffodil to gain the Award of Merit from the Royal Horticultural Society, London. A number of valuable cups are competed for annually at the Hobart Horticultural Society's shows and it would be of interest to quote a few of the late Mr. Radcliff's successes.

In 1928 the Wm. Jackson Cup was presented for the best new seedling Daffodil raised in Tasmania. During the past twenty-one years Mr. Radcliff was awarded this cup on ten occasions.

In 1929 the late Mr. C. E. Webster, then President of the Society, presented a perpetual cup for twelve Tasmanian raised seedlings. In this competition Mr. Radcliff secured the honors on eight occasions, was placed second six times and third three times.

The definite improvement in the quality of the pink toned seedlings induced Mr. T. D. Raphael to present a special cup to be awarded annually to the best pink crowned daffodil and in the ten years of this contest Mr. Radcliff scored eight victories, the above-mentioned Rosario being successful four times.

Space will not permit more than a brief mention of a few of Mr. Radcliff's noted seedlings.

Bonnington, a bicolor ajax of wonderful type, carriage and form, has received more championship awards for "best bloom" than any of his seedlings. Robert Montgomery, a fine yellow 1-A, has been consistently prominent—Pink O'Dawn was probably the first Australian seedling to be classed as a "pink trumpet" variety. Dawnglow was bred from this one and was a distinct improvement on the parent as regards color. Moina, referred to above, was produced the same year.

Keeping closely to a set line of breeding, Mr. Radcliff continued each year to produce something more interesting and with marked improve-

ment, particularly with regard to true pink coloring of the cup or crown. Rosario first saw the light in 1938 and created a sensation amongst the daffodil fraternity. The following year Roselands was staged for the first time, and was acclaimed as the best pink trumpet to date. This flower came from a different parentage than those previously noted.

Fig. 8. C. E. Radcliff, 18___-1949

Mr. Radcliff's next surprise bloom was staged in 1944 under the name of Kuranja. This seedling pink won the grand champion award on its first appearance. One of its parents is Dawnglow, the product of Pink O'Dawn.

Mr. Radcliff's success in raising a large number of high-quality blooms in all the classified sections was remarkable, and in proof of this, his seedlings have gained the highest awards in all sections of the various daffodil shows held annually throughout the State.

Mr. Radcliff's death was unexpectedly sudden as he appeared to be making a satisfactory recovery from a recent illness. His passing comes as a great shock to all who enjoyed his genial friendship and advice and the Hobart Horticultural Society's committee has suffered a dual loss of its two leading daffodil hybridists, the late Wm. Jackson having passed away less than twelve months ago.

In recent years Mr. Radcliff became interested in the culture of bearded Iris and his rapidly increasing collection contained many of the new introductions from England and the United States. He was also the first to introduce the new strains of "Pacific Giant" Delphiniums to Tasmania and had been working on crossings of the two strains, with the same keenness which brought him so much recognition in the daffodil world.

Naturally we must, as time passes, lose these great personalities, still (as in the case of the writer of this abridgement) when an intimate association, extending over a period of some thirty-odd years, is suddenly closed by death, the loss of such a true friend and sportsman strikes deeply.

Our sincerest sympathy is extended to the relatives and friends of Mr. C. E. Radcliff.

—J. R. Byfield, President,
Hobart Horticultural Society

II.

Mr. C. E. Radcliff, who died at his home at Sandy Bay, Hobart, Tasmania, on March 13, 1949, was the most notable of the younger generation of Daffodil hybridists. So successful was he that in 1946 he was awarded the Peter Barr Memorial Cup by the Royal Horticultural Society of England for his work in the production of varieties with pink coloration. At the time of his death he had over two hundred and thirty selected varieties showing pink in the coronas. Noteworthy varieties raised by Mr. Radcliff include: Pink of Dawn, a bicolor trumpet with a crown of blush pink; Rosario, a Leedsii with deep rosy frilled cup, and Kuranja, which at the Hobart show in 1944 was awarded the Champion prize for the best bloom of the show and the finest pink staged to that date. Mr. Radcliff did not, however, confine his attention to the raising of pinks, and many other fine varieties stand to his credit, among which are his splendid yellow trumpet, Robert Montgomery; his bi-color trumpets, Bonnington and Dawn Glow; his fine Leedsii, Nautilus; his Incomparabilis, Moina; and his Barrii, Portia. He worked unceasingly in popularizing Daffodil growing in the State of Tasmania and distributed his bulbs freely to societies in different parts of the island. He was in constant touch with growers overseas, and at the time of his reath had probably the finest collection of modern daffodils in the Commonwealth. He was very thorough in all his operations and so successful was he that at the annual Tasmanian shows he placed reliance on productions of his own raising rather than imported varieties.

An outstanding personality, those who met him could not but be impressed by his character and his sound judgment. His loss to the cult in Tasmania was a very serious one but he has so imbued other growers in the island with his enthusiasm and has left such a legacy of fine things that the future of the *Narcissus* in Tasmania is safely established on a firm basis. His daughter Miss Ruth Radcliff is carrying on the good work.

—*Harold Alston*

HORTICULTURE IN AUSTRALIA

FRED M. DANKS, *Australia*

The development of *Narcissus* breeding in Australia has been detailed in part in 1946 HERBERTIA, and further information is furnished by Harold Alston and J. R. Byfield in the present issue of HERBERTIA.

Mr. G. K. Cowlishaw has written on Hybrid Brunsvigias (also called Hybrid Cape Belladonna Lilies), and other amaryllids in Australia in 1935 HERBERTIA. In gardens one will find quite unusual shades of Hybrid Brunsvigias, and the name of Bailey is associated with the white one—it undoubtedly came originally from some Sydney garden. They grow so freely, even when discarded on the rubbish heap, that they have little value. White *Brunsvigia* hybrids are still uncommon, but every tone in pink is to be found for the searching. Very few hybrids have been named, but the late Mr. Clark had many, and Mr. Aylett of Mangoplah, N. S. W., sent some overseas that were welcomed in their new homes.

The true *Amaryllis* (formerly erroneously known as Hippeastrums) were freely grown along the eastern coast line even back in the last century, and would flower year after year among the grass in the open without any attention. The *Amaryllis* hybrids were possibly ahead of anything that others had at that time, but the records are obscure so that it is not possible to duly credit the early workers. Fortunately Mr. E. Both has given part of his attention to Hybrid *Amaryllis* for some years and his interesting article appears elsewhere in this issue of HERBERTIA.

The history of the other amaryllids in Australia—*Nerine, Lycoris, Crinum, Zephyranthes, Hymenocallis,* etc.—has still to be written, and this should be the objective of the 2ND AUSTRALIAN EDITION of HERBERTIA to appear later.

As to climate, Tasmania more nearly approaches the English conditions, and with convenient traveling distances between scenic attractions that rival any on the mainland. It is a tourists' joy. The Harbor of Hobart, with 60 feet of water beside the oversea berths, is an asset apart from its expansive beauty; and the graceful curve of the floating bridge is a novelty that in no way spoils it. Water power from high inland lakes provides industry with current and in every way this smallest of the States is especially favored. These same lakes too give feed to introduced fish that enables them to outgrow less favored relatives. The 20-pounders among the rainbow trout are sought by fishermen from all over the world.

All along this southern coast line, both of the mainland and the "tight little isle" there are changes in climate that are so characteristic. Anything from "Monsoonal Mugginess" or the raging desert gales, as from a furnace, to the fresh blows straight from the Antarctic wastes, can come at all seasons. In the winter dull days are dreary but just beyond the ranges to the north, the sunshine is warm though the nights are cold. There are a few weeks when growth is slow, but once the earliest spring appears there are many delightfully fine days to enjoy.

Most ornamental plants will grow here. Many can be made to bloom in the winter. For the propagation of cuttings little glass is used. Frosts are not heavy and some areas are entirely free from them. South Australia gets more heat and milder winter weather. Perth, with an average winter minimum of over 40° F., can grow nearly anything at any time. Hill country near at hand gives the cooler conditions in the summer.

The East Coast, lapped by Pacific waters, is productive along its whole 2500 miles, quickly reaching to the tropic climes. Even within the State of New South Wales, the sugar cane is grown with bananas and other tropical fruits, and Queensland with its coastal rains in yards per day grows still more. Inland conditions everywhere become dryer, for the coastal range from the South Australian border to the tip of Cape York is never far from the sea. Irrigation has done much and will help still more.

Horticulturally the possibilities have rarely been exploited, but when you can enjoy daffodils on the cool mountain slopes of Tamborine just south of Brisbane within sight of the ocean growing under banana plants, it is clear that there are many unrealized possibilities.

Having mentioned some of our climatic variations, some records might be of interest. Queensland and New South Wales have more humid conditions in the summer but along the southern coast line, the worst days give temperatures into the hundreds that have to be felt to be appreciated. These come with a raging gale right from desert areas and a blistering sun. The highest ever recorded was 114° F. in the shade in Melbourne—Mildura gets 124°—and that was accompanied by two other days in the one week above 110. In over 80 years of recording, nothing above 108° had been registered and this unusual reading was to a large extent due to the ghastly forest fires that destroyed everything before them. Readings at 100° average five per season and there are some 15 days in the 90's which are nearly as trying, but mostly they come as single "trials" and by shutting the brick houses the indoor temperatures are kept to normal. Actually the average summer day is ideal—about 75° with a cloudless sky and a fresh breeze. Winters are mild though sometimes dull.

Returning members of the armed forces in the last war have no doubt taken back much information on the type of country this is but for the benefit of those who have not had this personal contact, it may be of interest to state that the two main cities have each over a million inhabitants. Melbourne is laid out on square lines with wide streets and

[HORTICULTURE IN AUSTRALIA—Fred M. Danks, continued on page 50.]

I. REGIONAL ACTIVITY AND EXHIBITIONS

DAYLILY REPORT, 1948

ELMER A. CLAAR, *Chairman, Hemerocallis Committee*

On June 22, 1948, I visited the Farr Nursery Company at Weiser Park, Pa., to see Dr. A. B. Stout's daylilies. (The Farr Nursery Company markets the Doctor's daylily introductions.) I am growing all of Dr. Stout's introduced varieties so I was particularly interested in his seedlings. As in the past, we are assured of some very fine things in the future from the Doctor. However, in order to avoid causing him and the Farr Nursery Company any undue correspondence, I hasten to say that these seedlings will not be available for a number of years. I was assured by Mr. Seyler, the daylily enthusiast of the Farr Company, that there are a considerable number of new doubles of varying types coming on. These were not in bloom but I saw some very fine improvements in bloom in the intermediate types.

The most outstanding of all the intermediate daylilies, in my opinion, was an eyed variety, very much like Mrs. David Hall, but which blooms considerably later than Mrs. David Hall. In fact, had it not been for the time of the year, I would have thought it was Mrs. David Hall. Both of these plants have much more substance, a clearer color, and a much more contrasting eye than Mikado.

I also saw a plant very similar to George Yeld, which I have no doubt will be introduced in due time, and another one which is the largest intermediate yellow I have seen up to this time.

Of the named varieties, Baronet was most impressive. This plant is a good large red, comparable to the best reds in any blooming season.

In discussing daylilies with Mr. Seyler, he indicated that he is very fond of Autumn Prince and Afterglow and that Afterglow is particularly popular. It is, I believe, one of the very best pastel types of daylilies. Mr. Seyler also is very fond of Firebrand and Georgia. The latter is more peach-colored than Bertrand H. Farr. We discussed many of the other lovely things that the Doctor has introduced, but all of these have been written about many times.

I spent the summer in Europe and while there went to the Kew Gardens (the Royal Botanical Gardens) in England. I contacted the main gardener, who told me that they did not have any daylilies. I saw the list of the varieties grown at Wisley but I had grown or am growing all of them, and with time so precious, I did not go there.

I took a trip to Mr. Amos Perry's, in southeast England, and spent a day at his place. Mr. Perry was head of Perry's Hardy Plant Farm, which is known throughout the world. This fine old gentleman (he says he is seventy-eight but he does not look it) is one of the world's foremost plant explorers and horticulturists. As a member of the Alpine Club he has brought back and introduced some of the world's finest alpines and

perennials. His labors associated with water plants have carried him many times (I believe he said five) to the swamps of Lapland, hundreds of miles inside the Arctic Circle. However, he has been interested in all hardy plants and is one of the pioneer hybridizers of daylilies, and one of the first to sing their praises. His exhibits at most of the horticultural shows in England and on the Continent have been enthusiastically commented on. He staged the first water garden exhibit in England in 1902. The awards he has received have been too numerous to mention. His publications have been many and varied.

A year or so ago Mr. Perry retired and his two sons, Gerald and Reginald, are carrying on the business. He went to Weeley Heath, near Clacton-on-the-Sea, in Essex, purchased a small plot which he could care for himself (about an acre, I should judge) and continues enthusiastically hybridizing daylilies and collecting rare plants. Most of his acreage was planted in daylilies.

When in 1937 I wrote to Mr. George Yeld, the man who first hybridized daylilies, asking that he send me his 1937 hemerocallis catalog, I received the following reply:

"I am sorry I cannot send you my 1937 hemerocallis catalog. I do not issue one. I am an amateur.

I would suggest you should apply to Mr. Amos Perry, V.M.H., Hardy Plant Farm, Enfield, Middlesex, England. Mr. Perry is the ablest and most widely known cultivator of hemerocallis in this country."

Mr. Perry told me he first became interested in daylilies when he met Mr. George Yeld in 1890. Mr. Yeld became interested in daylilies in 1877 and made the first known crosses of this flower, and showed Apricot, his first named hybrid, in 1892.

Mr. Perry said he introduced his first seedling in 1900 and called it Amos Perry. He said further that he made the first cross of *Hemerocallis fulva* and named it Margaret Perry, about 1920, which flower still is extensively listed in American catalogs. Almost every year thereafter he introduced a number of varieties:

1923—Circe; E. A. Bowles; Yellow Hammer.

1924—Eldorado; Erika; George Yeld (selected from Mr. Perry's seedlings by Mr. Yeld to be named after himself); Gladys Perry; Iris Perry; Lady Fermor Hesketh.

1925—Gold Imperial; Gold Standard; Imperator; Mrs. Perry; Thelma Perry; Viscountess Byng.

1926—Elizabeth Pyke; June Boissier.

1928—Byng of Vimy; Dawn; Hiawatha; Moonstone; Reggie Perry; Revenge, H.MS.; Rose Queen; Minnie Nightingale.

When we remember that Mr. Burbank named Calypso in 1917, that Mr. Farr named Ophir in 1924, that Hyperion was introduced by Mr. Mead in 1928, that Mr. Betscher introduced his first seedling, Lemona, in the same year, that Dr. Stout named his first introductions in 1929, that Hans Sass did so in 1930, and that Mrs. Nesmith did likewise in 1933, it can be seen that Mr. Perry was truly a pioneer in this field. He, of

course, introduced many other daylilies in the years following. Most of his daylilies are listed in American and European catalogs.

Mr. Perry evidently has not been hybridizing for intermediate bloomers as there were very few daylilies in bloom at the time I was at Weeley Heath, and I would estimate that he now has a half acre of daylily seedlings.

The Perry Hardy Plant Farm lists a number of new daylily introductions in its 1948 catalog. I ordered the following pink and red varieties, and they sent me some seedlings:

Edith Shewring, Helen Lindsay Smith, Marie Ballard, Pat, Ballerine, Rugby, Betty Stewart, Conspicua, Gladiator, Katherine Clark, and Kathleeen Hardy-Smith.

While talking with Mr. Perry, he told me, "My Richard Thornby is one of my greatest treasures, worth waiting 55 years for. On opening, the medium-sized flowers are a delightful shade of rich orange; at midday (2 to 3 o'clock) they start to assume a snow-white shade, spotted and splashed orange, with a deep orange reverse and base." Mr. Perry said it is a remarkable flower and that he has marked it seven X's. Evidently, Mr. Perry does not object to a flower fading if, when it does, the result is beautiful. Unfortunately, Richard Thornby was not in bloom when I visited there.

Mr. Perry carried the torch for daylilies as one of the first hybridizers. He sang the praises of daylilies when few others knew about them. More especially, he listed them in his catalogs, which were internationally distributed, and he surely must have spent large sums of his own money as a pioneer prophet of our favorite summer perennnial when folks paid but a dollar or two for a new introduction. Hail to Mr. Perry and all honor to him! Spending a day with him was an honor, a privilege, and tremendously inspirational.

While in England, I also was at Bournemouth-on-the-Sea and saw a number of fulvous daylilies in the gardens of the Hotel Royal Bath.

In Switzerland, between the Furka Pass and the Brunig Pass, we came to the small village of Meiringen, some miles on the other side of the Rhone Glacier. This village is nestled in a valley, with high mountains all around it. Here again, at the hotel, I saw a number of large beds of fulvous daylilies.

I also saw some fulvous daylilies at the Hotel Villa d'Este at Lake Como.

At the town of Voss, on the Bergen Railway, in Norway, the Hotel Fletcher had many, many daylilies in its gardens—all fulvous. This also was true on the trip from Voss to Fossli, where at Granvin there were a large number of fulvous daylilies in the hotel garden.

On August 15 I was at Gothenburg, Sweden, where I went to the Gothenburg Botanical Gardens, the Tradgardsforiningen. These gardens are beautiful, very much like the English gardens. One unusual effect was a plot of grass which had over 100 specimen plants from five to ten feet apart, and at least ten feet in diameter. In this plot were huge clumps of daylilies Flava, Mrs. Perry, George Yeld, Citrina, Baroni,

1949 Amaryllis Queen of New Orleans

Plate 2 (See opposite page for additional legend.)

Double Fulva, Gold Imperial, Golden Dust, Radiant, and Ochroleuca, and some others without markers. Each had a separate bed.

By being abroad during the summer months, I missed the principal blooming season in my own garden, and especially that of some 82 new daylilies that I acquired in 1947, and which I was very desirous of seeing in bloom. In 1948 I acquired an additional 46 plants, all of which I shall be anxiously looking forward to seeing in 1949.

NEW ORLEANS AMARYLLIS SHOW, 1949

Mrs. W. D. Morton, Jr., *Pres. Garden Circle, New Orleans*

The first official New Orleans Amaryllis Show, sponsored by the New Orleans Garden Circle, was held on April 2–3, 1949. The Show was beautifully staged on the entire lower floor of the Jewish Community Center.

Amaryllis of various colors were displayed against a background of black and silver. Flower arrangements were entered from all of the local Garden Clubs. The spacious halls and one-half of the lower floor reception rooms were used for individual displays, and ribbons and sweepstakes were awarded in all classes.

The New Orleans Amaryllis Show was a feature of the New Orleans Spring Fiesta, and the hostesses were Fiesta ladies in antebellum costumes. One half of the lower floor, with a stage of spring setting of dogwood, palms, and other potted plants, love birds and canaries, provided an appropriate setting where Miss Rosemary Wingrave, daughter of Judge and Mrs. John J. Wingrave, was crowned the 1949 Amaryllis Queen of New Orleans (Plate 2).

The registry disclosed that there were visitors from every State of the Union, and three foreign countries. Six competent judges had charge of the awards.

Plans are now being made for the 1950 New Orleans Amaryllis Show which promises to surpass the successful 1949 Show.

AUTUMN AMARYLLIS SHOW, POMONA, CALIF., 1948

Cecil Houdyshel, *California*

The Autumn Amaryllis Show, Pomona, Calif., Sept. 23, 1948, was held in conjunction with the flower shows at the Los Angeles County Fair.

Plate 2. (See opposite page.) The Queen of the New Orleans Amaryllis Show, 1949, Miss Rosemary Wingrave, center, is crowned by Safety Commissioner Bernard J. M'Closkey at ceremonies at the Jewish Community Center. Others from left are Miss Alice Toso, Mrs. Z. B. Crawford, Mrs. John J. Wingrave, mother of the queen, Miss Lillah V. Schmidt, Miss Annette Ruckstuhl, Mrs. George Ronstrom, Miss Clementine Doskey and Mrs. Mark Sackett. The show was sponsored by the Garden Circle of New Orleans. Photo by *The New Orleans Times-Picayune.*

Mrs. Leonard Swets, Riverside, received 7 first and 5 second awards; Las Positas Nursery, Stanta Barbara, received 5 first, 1 second, and 1 third awards; Oakhurst Gardens, Arcadia, and W. R. Rice, Downey, received one first award each; Howard & Smith, Montebello, received 1 first and 3 second awards; Mrs. Kenneth B. Anderson, La Canada, received 1 first award; Mrs. Leonard Slosson, Los Angeles, received 2 second and 3 third awards; and Cecil Houdyshel, La Verne, received 7 first, 13 second and 3 third awards.

[HORTICULTURE IN AUSTRALIA—Fred M. Danks, continued from page 44.]

fine open areas of park lands near the city. Sydney in a restricted narrow space is set on one of the remarkable harbors of the world, with ample accommodation for shipping and the settings for beautiful waterside homes. Other capital cities drop away in numbers and the country towns are small. Newcastle, with its steel works producing the products cheapest, is a fine town even though similar industries now have spread to Port Kembla, further south, and to Whyalla in South Australia.

Horticulturally the demand for plants and cut flowers is helping to establish an industry that is capable of still further expansion. In keeping with other lands, the growing realization of all that can be accomplished by selective breeding opens up new possibilities. With climate and soils to help there is hardly a limit as to what can be accomplished in the future. In this development of horticulture in Australia, we welcome the cooperation of American horticulturists. Australia has fine native plant seeds and also fine selected strains and clones of introduced plant subjects to give in return.

[AMARYLLID NOTES—Hamilton P. Traub, continued from page 82.]

Ipheion Lorentzii (Herter) Traub, **comb. nov.** Syn.—*Beauverdia Lorentzii* Herter, in Boissiera, VII, 509, fig. 54. 1943.

Ipheion hirtellum (Kunth) Traub, **comb. nov.** Syn.—*Triteleia hirtella* Kunth, Enum. Pl. 4: 465. 1843.

Ipheion Felipponei (Beauverd) Traub, **comb. nov.** Syn.—*Nothoscordum Felipponei* Beauverd, in Bull. Soc. Bot. Geneve, ser. 2. VIII, 267, c. fig. 1922.

Ipheion Sellowianum (Kunth) Traub, **comb. nov.** Syn.—*Triteleia Sellowianum* Kunth, Enum. Pl. IV, 466. 1843.

Ipheion subsessile (Beauverd) Traub, **comb. nov.** Syn.—*Nothoscordum subsessile Beauverd,* in Bull. Herb. Boiss. ser. 2, VIII, 997, c. fig. 1908.

Ipheion lloydiiflorum (Beauverd) Traub, **comb. nov.** Syn.—*Nothoscordum lloydiiflorum* Beauverd, in Bull. Herb. Boiss. ser. 2, VIII, 999, c. fig. 1908.

Ipheion vittatum (Gris.) Traub, **comb. nov.** Syn.—*Milla vittata* Gris., in Goett. Obh. 24: 318. 1879.

Ipheion Tweedieanum (Gris.) Traub, **comb nov.** Syn.—*Milla Tweedieana* Gris., in Goett. Abh. 24: 318. 1879.

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND PHYLOGENY]

AUSTRALIAN AMARYLLIDS[1]

J. H. Willis, *B.Sc.*
National Herbarium, South Yarra

By comparison with similar areas in other parts of the world, Australia's representation of the Daffodil and Garlic Family is scanty. Only 80 species are at present recognized for the Commonwealth (cf. about 230 in South Africa) and, upon further critical revision, some of these may prove to be no more than varieties. Nevertheless, there is an astonishing diversity of stature, form and beauty among the four score kinds—from the large-flowered, intensely fragrant Crinums of our eastern tropics to the almost odorless woolly and bizarre Kangaroo-paws of the far South-west from the tiny Golden Star of cool damp southern heaths and meadows to the gigantic Spear Lilies of north-east New South Wales and Queensland forests.

Bentham's classification (in *Flora Australiensis VI*, p. 417, 1873) has been followed by all Australian botanists, except that his tribe *Hæmodoreæ* is now given family rank and the curious *Campynema* is transferred from *Iridaceæ* to the amaryllids (near *Hypoxis*). *J. Hutchinson* (*Families of Flowering Plants—Monocotyledons*, 1944) raises the tribes *Agaveæ* and *Hypoxideæ* to the status of distinct families and places the *Conostyleæ* in *Hæmodoraceæ*, thereby narrowing the old family *Amaryllidaceæ* (as it occurs in the Commonwealth) to two tribes of bulbous plants with umbellate inflorescences. This new concept has not yet been adopted by systematists in Australia and, for the present, I prefer to deal with *Amaryllidaceæ* in its older, wider sense.

Let us now indicate the size and geographical range of our twelve genera:

1. *CRINUM* (11 Aust. spp.—*C. flaccidum* on Murray near Ned's Corner, Vic.)

This genus, of more than 120 species, is widespread in tropical and sub-tropical countries, the large white or rosy flowers borne on tall fleshy scapes and often sweetly perfumed. Australian species are found variously from the Flinders Range (S. Aust.) and lagoons along the Lower Murray and Darling water systems to Port Jackson, thence up the East

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[1]EDITORIAL NOTE.—Mr. Willis follows the older classification of Bentham & Hooker (1883) with some modification which is not officially recognized in Herbertia. His viewpoint is presented as a customary courtesy. The more modern classifiaction of Hutchinson (1934) was adopted for Herbertia in 1934.

Australian coast to Cape York, the Gulf country, Arnhem Land, and the Victoria River watershed (N. Terr.) with an outlier in the Kimberleys (W. Aust.)

2. *EURYCLES* (2 Aust. spp.)

Extends from Moreton Bay to Cape York and on through the East Indies to Malaya. The flowers are remarkably like those of a white narcissus.

3. *CALOSTEMMA* (4 spp. Aust. only—*C. purpureum* at Lake Hattah, Vic.)

Also jonquil-like, these purple, blotched, yellow or whitish-flowered bulbs range from Spencer's Gulf (S. Aust.), through the Murray-Darling region to the Darling Downs (Q'land), Rockhampton and the Gulf of Carpentaria.

4. *DORYANTHES* (2 spp. Aust. only)

The bulky "Spear Lilies" are not as fleshy as their close American relatives of the genus *Agave;* they occur between Port Jackson and the Burdekin River (Q'land), the spikes of large waxy-red flowers sometimes attaining 16 feet in height.

5. *CAMPYNEMA* (1 sp.—endemic in Tasmania)

A little mountain plant with green perianth and bright red anthers.

6. *HYPOXIS* (6 Aust. spp. *H. hygrometrica, glabella* and *pusilla* in Vic.)

A large widely distributed genus of about 90 species, half of which occur in South Africa. Certain species are to be found all around Australia and Tasmania, except in the arid inland regions; in early spring their golden starry flowers are dotted over acres of wet grassy land.

7. *CURCULIGO* (2 Aust. spp.)

A widespread group of which both Australian species occur also in tropical Asia. Leaves are aspidistra-like, the yellow flower clusters often nodding.

8. *TRIBONANTHES* (5 spp. endemic in West Aust.)

9. *CONOSTYLIS* (37 spp. " " " ")

10. *BLANCOA* (1 sp. " " " ")

11. *MACROPIDIA* (1 sp. " " " ")

12. *ANIGOZANTHOS* (8 spp. " " " ")

The last five genera, constituting the tribe *Conostyleæ* and embracing 52 of the 80 Australian amaryllids, are confined to the southwest of

Western Australia between Shark Bay and Israelite Bay; they favor the great sand-heath areas near the coast, where their flamboyancy adds materially to the landscape effect in many places. All are brightly hued flowers with a curious woolly vestiture.

The only genera reaching Tasmania are *Hypoxis* and *Campynema*, the latter endemic, while in New Zealand there is but one amaryllid (*Hypoxis pusilla*).

Apart from their æesthetic and decorative value, Australian amaryllids have few uses. North Queensland aborigines roasted and ate the roots of *Curculigo ensifolia*, while those of Mitchell Downs are said to have eaten the bulbs of *Hypoxis hygrometrica*. Bulbs of the "Darling Lily" (*Crinum flacidum*) yield a passable arrowroot and were once used successfully at Wilcannia (N.S.W.) as a substitute for flour. *Doryanthes* leaves have a strong fibre and like the New Zealand Flax should prove commercially useful.

KEY TO THE GENERA OF AUSTRALIAN *AMARYLLIDACEÆ*.
(adapted from those of Bentham and Hutchinson)

1a. Inflorescence umbellate, subtended by an involucre of one or several spathe-like bracts (*Euamaryllideæ*)
  2a. Corona absent; no scales or teeth between the stamens ..... *CRINUM*
  2b. Corona present, formed by the expanded filaments which are often connate at the base.
    3a. Ovary 3-locular; ovules 6; leaves ovate, petiolate, with distant primary veins ..... *EURYCLES*
    3b. Ovary 1-locular; ovules 2-3; leaves narrow, with close venation ..... *CALOSTEMMA*
1b. Inflorescence neither umbellate nor subtended by spathe-like bracts
  4a. Large plants with inflorescences exceeding 6 feet in height; flowers large and fleshy, leaves radical, 4-6 feet long (*Agaveæ*) ..... *DORYANTHES*
  4b. Small plants with inflorescences seldom 4 feet high; flowers not fleshy; leaves under 18 inches long and usually scattered
    5a. Flowers entirely glabrous or with a few simple hairs; embryo immersed in the endosperm (*Hypoxideæ*)
      6a. Flowers solitary or few, with segments divided to the ovary; fruit capsular,
        7a. Styles free; anthers opening outwards ..... *CAMPYNEMA*
        7b. Styles connate; anthers opening inwards ..... *HYPOXIS*
      6b. Flowers sessile in a dense spike, usually tubular; fruit fleshy and indehiscent ..... *CURCULIGO*
    5b. Flowers very woolly, commonly with branched hairs; embryo not wholly enclosed by the endosperm (*Conostyleæ*)
      8a. Ovary superior; anthers with terminal appendages; perianth deeply divided, rotate ..... *TRIBONANTHES*
      8b. Ovary inferior; anthers without appendages; perianth usually remaining tubular
        9a. Perianth regularly split into lobes
          10a. Flowers in dense heads, tube short ..... *CONOSTYLIS*
          10b. Flowers in 1-sided racemes, tube comparatively long ..... *BLANCOA*
        9b. Perianth much more deeply split on lower side
          11a. Tomentum black; ovules 1 per loculus ..... *MACROPIDIA*
          11b. Tomentum variously colored; never black; ovules 2-4 per loculus ..... *ANIGOZANTHOS*

KARYOLOGY OF SOME SOUTH AFRICAN AMARYLLIDACEAE[1]

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I. INTRODUCTION

The present paper is the result of a 4-year study undertaken at the University of Pretoria. The object was to determine, as far as possible, from cytological data the phylogenetic relationship of the South African genera of the *Amaryllideae* (sensu Pax & Hoffmann). With this object in view 25 native species of random selection representing 12 genera of the *Amaryllidaceae* were collected and investigated.

It was soon found that the meiotic division occurs while the inflorescence is still enclosed in the bulb. This meant the destruction of a bulb for each inflorescence to be investigated. As the number of bulbs available did not allow this costly process, attention was restricted to the somatic figures.

Herbarium specimens of all the investigated species were prepared and now lie deposited in the HERBARIUM OF THE UNIVERSITY OF PRETORIA (UPR). A list of these species is given below, indicating the 2n chromosome number and the locality from which they were obtained.

My sincere thanks are due to Prof. Dr. M. G. Mes and to Dr. H. G. Schweickerdt, senior lecturer, of the Dept. of Botany, for their encouragement, guidance and facilities provided for carrying out this work; and further to the staff of the NATIONAL HERBARIUM, PRETORIA, for the identification of specimens and the loan of literature. The encouraging and constructive suggestions of Prof. Quintanilha, Director of the Cotton Research Institute, Lourenco Marques, are sincerely appreciated.

II. MATERIALS AND METHODS

In preparing the slides it was found that the squash method yielded the best results in the shortest time. The root-tips were fixed in a solution of 3 alcohol to 1 acetic acid for 24 hours, after which they were colored in acetic orecein (prepared according to the formula of Darlington and la Cour (*1*)[2] for 4 hours.

The slides were made permanent according to the schedule of McClintock (*2*). The usual method of combining coverslip and object glass was not practiced here as it is impossible to replace the coverslip in its original position. This means that one layer of cells is often superposed on the other. The two were, therefore, always mounted separately in Canada Balsam.

Of the slides prepared in this way many are 3 years old and seem to be permanent.

The photographs were taken through a "panphot" kindly loaned by

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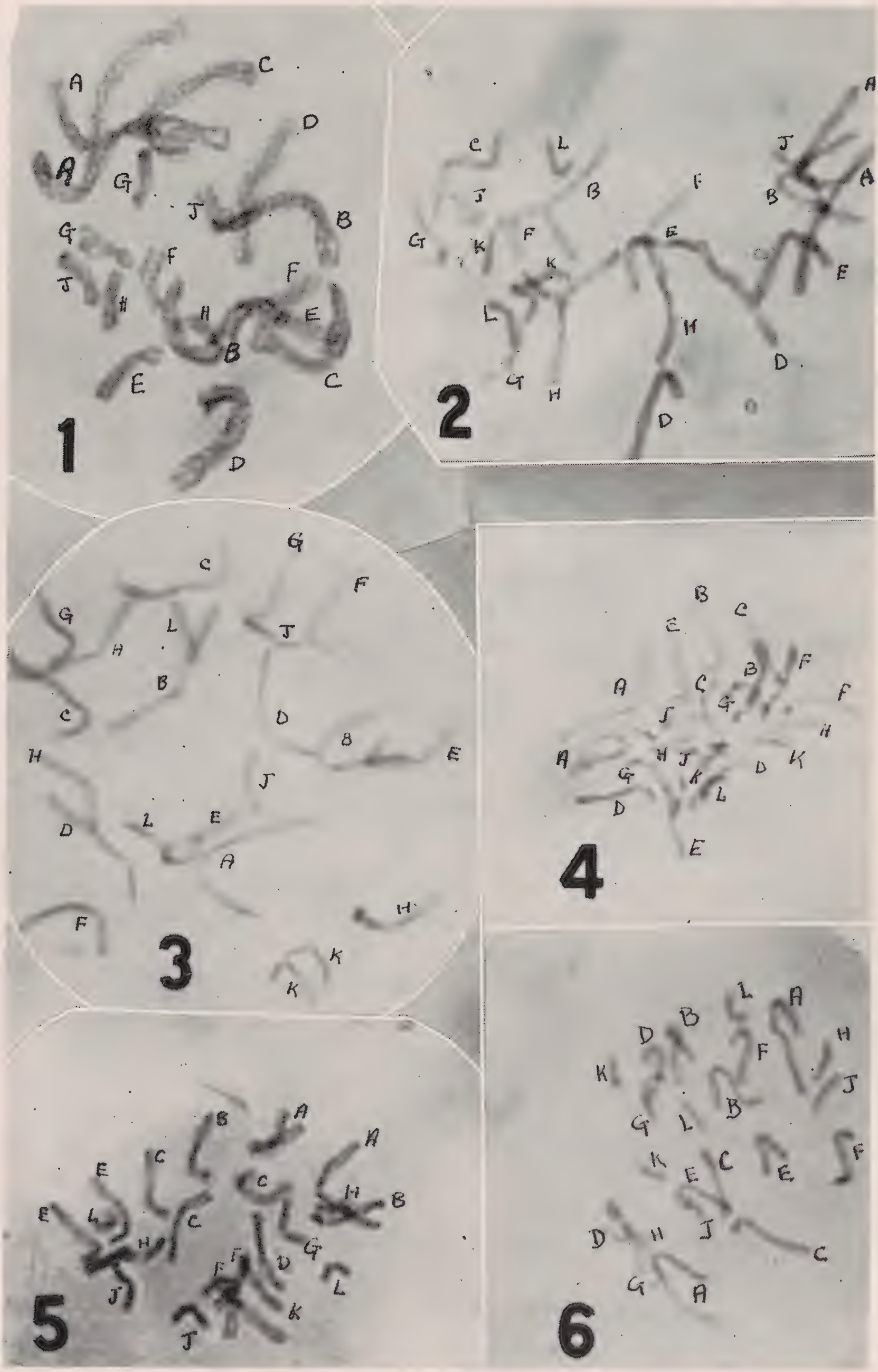
[1]Submitted to the faculty of Science of the University of Pretoria in partial fulfillment of the requirements for the degree of Doctor of Science.

[2]Italic numbers in parentheses refer to Literature Cited at the end of the article.



Amaryllid chromosomes—1, *Haemanthus magnificus;* 2, *Clivia miniata;* 3, *C. caulescens;* 4, *Nerine laticoma;* 5, *N. duparquetiana;* 6, *N. sarniensis,* diploid. (See text for magnification.)
Plate 3

the Division of Botany and Plant Pathology, Pretoria.

The drawings were made at table level by means of a Reichert microscope fitted with a 18a+ oil immersion lens, 25× ocular and a Zeiss camera lucida.

Figure 6 has been drawn from the means obtained from the measurements, for each species, of 2 well-developed metaphase figures. For the purpose of measurement the complexes were drawn as described above. Subsequently a few 10 μ divisions of a Leitz Object Mikrometer scale were projected under the same conditions. With the help of a pair of dividers the absolute length of each chromosome was obtained.

The measurements so obtained have not been analyzed biometrically. This will be done when more data are available.

III. PRESENTATION OF RESULTS

Where possible the chromosomes were arbitrarily divided into long, medium and short. The first letters of the Latin longum (l), medium (m) and brevis (b) were used in the formulae to express this condition. In addition the letters V, L and f were used to indicate the position of the kinetic constriction. V for a median constriction or one nearly so; L for sub-median; and f for sub-terminal to terminal, i.e., when the proximal arm is ⅓ or less of the length of the distal arm.

1. Genus HAEMANTHUS

The specimens collected near Bloemfontein presented many difficulties in identification. *H. hirsutus* and *H. nelsoni* are distinguished by the fact that the former has white flowers and hairy leaves, while the latter has pink flowers and less hairy leaves. The plants collected near Bloemfontein have pink flowers but the leaves are quite as hairy as those of *H. hirsutus*. At Wakkerstroom, where typical specimens of *H. hirsutus* were collected, one pink-flowered individual was found. On the basis of these characters apparently no clear line of distinction between the two species in question is possible. This fact seems to suggest that *H. nelsoni* and *H. hirsutus* are conspecific, a point worthy of further investigation.

Very little cytological information could be found in the available literature concerning the *Amaryllidaceae* of Southern Africa. On account of war conditions some of the publications were inaccessible, especially the papers published in Japan.

1. *Haemanthus magnificus* Herb. Plate 3, fig. 1. 2n = 18. Herbarium material: Gouws 186, 249 and 257 in UPR.

Material was collected from 3 widely separated areas. Numerically no difference was found in the genome. Although there is a very close similarity between the chromosomes of the different sets of plants, a small degree of variation was noticed, but whether this is due to some fault in the method or to intra-specific variation could not be determined.

Genome formula: 1:lL; 3:lF; 4: bf; 1:bV.

The 4 long chromosomes are readily identified optically. A, by its long proximal arm; B, by its extremely short proximal arm; while the

ratio of proximal to distal arm in the case of chromosomes C & D is about the same. They can, however, be identified by the fact that C is appreciably longer than D. As regards the E, F, G & H chromosomes, identification is extremely difficult. There is a certain degree of variation, but insufficient to make their optical identification certain. Chromosome J is the only bV type and thus quite distinct.

2. *Haemanthus nelsoni* Bkr. (?). Figure 9, 807. 2n = 16. Herbarium material: Gouws 260 and 263 in UPR.

Genome formula: 1:lL; 2:lf; 2:mf; 2:bV; 1:bf.

Chromosome A is the only lL type and thus readily recognizable. Chromosome B has the shortest proximal arm of the long chromosomes. Its correspondence with chromosome B of *H. magnificus* is evident. Most probably these are homologous. Chromosome C is longer than B in both the proximal and distal arms. The 2 medium chromosomes D & E can be identified by the fact that they are much shorter than the previous two and by E having a clearly shorter proximal arm than D. Chromosomes F & H (bV type) can be identified by the fact that F is a much larger V than H. Chromosome G is the only bf type and can therefore be readily identified.

Evidently the genus *Haemanthus* has so far received very little attention from cytologists. Apparently the only publication on this genus is that of Sato (*3*), quoted by Darlington and Janaki Ammal (*4*). On basis of this article both *H. albiflorus* and *H. coccineus* possess 16 chromosomes. In a garden plant of *H. albiflorus* the same author found 16 + 2f. Of the species here investigated, *H. nelsoni* and *H. hirsutus* each have 16, while *H. magnificus* has 18 somatic chromosomes. There is, therefore an intra-generic variation in the chromosome number. In spite of the fact that only a few species have been investigated cytologically, it does seem that the 18 chromosome species is derivative. The larger number of short chromosomes in the latter species seems to indicate this presumption.

A double structure in the chromatids of this genus is very obvious (see Plate 3, fig. 1). Darlington (*5*) is of the opinion that each chromatid has a single chromonema. Where more than one was observed, he ascribes it to "bubbles of differential refractivity," caused by fixatives containing acetic acid. Investigators have, however, shown that the double structure can be observed after fixation in fluids containing ammonia, hydrochloric acid, nitric acid, but no acetic acid. Nebel & Ruttle (*6*) even claim 8 threads for each chromosome during metaphase.

The same double structure was observed in the chromatids of *Brunsvigia cooperi.*

2. Genus CLIVIA

3. *Clivia miniata* Regel. Plate 3, fig. 2. 2n = 22. Herbarium material: Gouws 321 in UPR.

Genome formula: 2:lL; 2:mf; 3:mL; 1:mV; 1:bV; 2:bL.

A & B, the 2:lL chromosomes, can be distinguished by the fact that A has a longer proximal arm than B. C & D, the 2:mf chromosomes, are too similar for optical identification. Chromosome E, mV type, is readily recognized by its extremely sub-median kinetic constricton. Chromosomes F, G & H, mL type, may well be identified by the fact that H is distinctly shorter than the other two and by the fact that F has a shorter proximal arm than G. Chromosome J is the only bV type and thus readily identified. Chromosomes K & L, bL type, are readily distinguished by the fact that K has a small trabant on the proximal arm.

4. *Clivia caulescens* R. A. Dyer. Plate 3, fig. 3. 2n = 22. Herbarium material: Gouws 109 in UPR.

Genome formula: 2:lL; 4:mL; 4:bL; 1:bV.

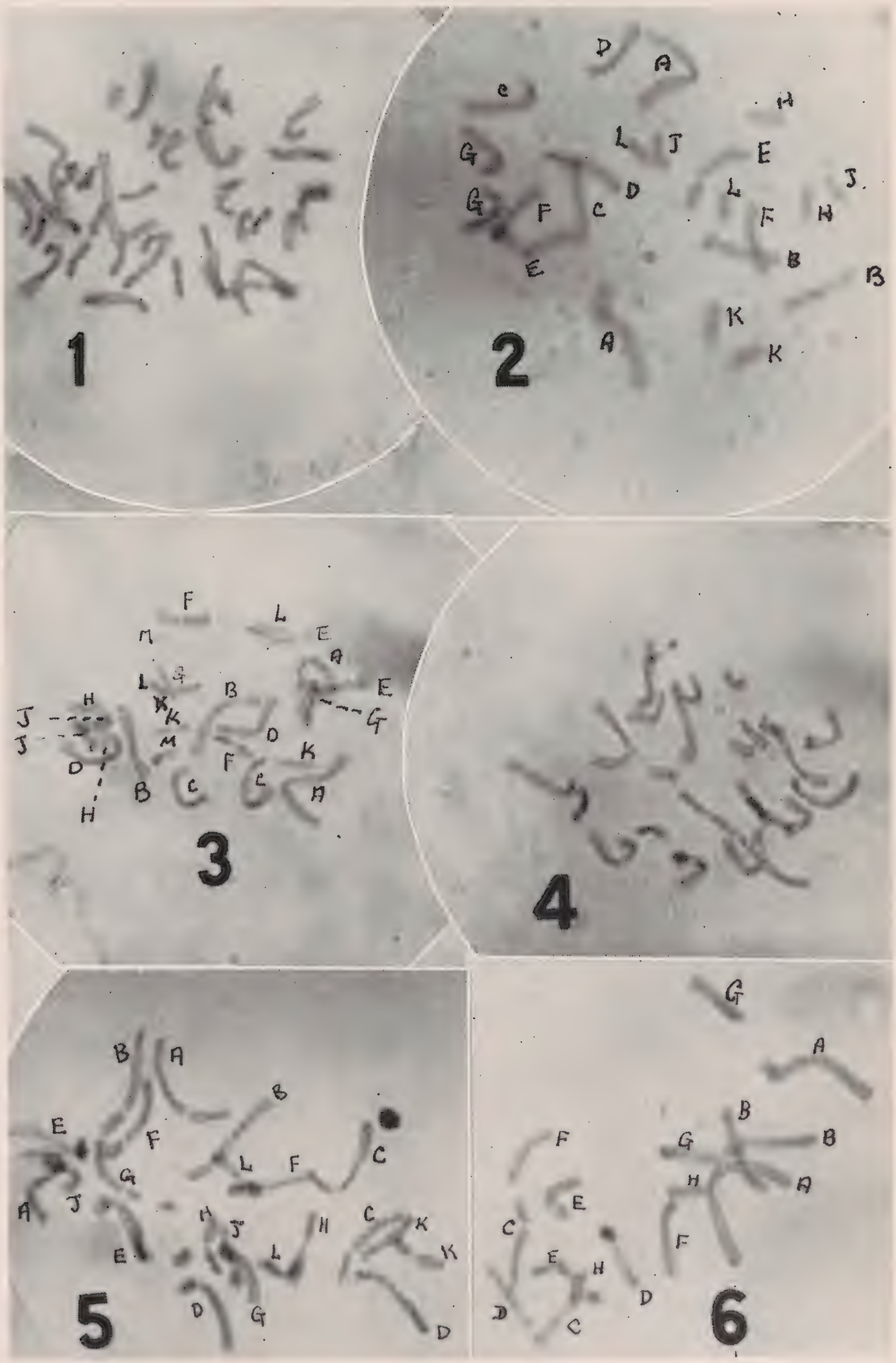
The A & B chromosomes, lL type, are too similar for optical identification. Chromosomes C, D, E & F, mL type, show a certain degree of variation, but so slight that optical identification is dubious. Chromosomes G, J & L, bL type, can be identified by the fact that G is appreciably shorter than the other two and by the fact that L has a decidedly shorter proximal arm than J. K, the other bL chromosome, is rendered distinct by the spherical trabant on the proximal arm. Chromosome H, being the only bV type, is distinct.

In the past, two species of the genus *Clivia* were investigated cytologically, viz. *C. nobilis* & *C. miniata*. Van Camp (*7*), according to Inariyama (*8*), found that in *C. miniata* n = 9, while Thornton (*9*), according to Inariyama (*8*), reported that n = 11 for the same species. Inariyama (*8*) found that both *C. nobilis* and *C. miniata* have n = 11. Flory & Yarnell (*10*) give in their list *C. miniata* as n = 9 or 11. Wittlake (*11*) reports that *C. cyrtanthiflora*, a cross between *C. miniata* and *C. nobilis*, has n = 9.

The species that were investigated here, *C. miniata* and *C. caulescens*, both have 2n = 22. So far this corresponds with the reports of Thornton and Inariyama.

If the number reported by van Camp, n = 9, is correct, it would mean that 11 is not the basic chromosome number of the species, but probably arose through polysomy or fragmentation. Since n = 11 has now been reported for 3 species of the genus and is also typical for a large number of species of the *Amaryllidaceae*, the number 9 cannot, without further proof, be accepted to indicate the genome of this genus.

In connection with the finding of Wittlake she herself makes the following remarks: "The interesting fact about these chromosomes is that they lie well within the range of *C. miniata* which varies from 18 to 22 somatic chromosomes according to the articles in the 1937 HERBERTIA by W. S. Flory and S. H. Yarnell. . . . So far the chromosome count itself has not answered the question regarding the failure with its seeds in the study of *C. cyrtanthiflora.*" It may be that an early abnormal division resulted in at least one daughter cell with a complete set of genes, and a complex of 18 chromosomes, not consisting of 9 homologous pairs. One could expect that a plant under such conditions would be sterile to a high



Amaryllid chromosomes—1, *Nerine sarniensis* (triploid); 2, *N. frithii;* 3, *N. filifolia;* 4, *N. masonorum;* 5, *Coburgia rosea;* 6, *Anoiganthus breviflorus.* (See text for magnification.)

Plate 4

degree.

Fig. 24 of Inariyama shows a high degree of correspondence with my Plate 3, fig. 2. His 2 pairs of long chromosomes correspond with my A and B chromosomes. His description of the shorter chromosomes, however, differs from my finding. His classification is based only on the position of the kinetic constriction, on basis of which he recognizes the following types: 2 with about median constriction; 1 with extremely subterminal kinetochore; and one with a terminal kinetochore.

The study of a large number of metaphase and anaphase figures revealed no figure with a terminal kinetochore. Often, however, it happens that the constrictions are not all clear as is also reported by Bahtia (*12*), but in anaphase chromosomes the position of the centromere can be determined with a fair degree of accuracy by the bend in the chromosome. Consequently anaphase figures were used to check the observations on metaphase figures.

Inariyama did not define his conception of either sub-median or subterminal. It is thus possible that some constrictions were regarded by him as sub-terminal, while they are regarded here as sub-median. From his fig. 24 it would appear, however, that he found more chromosomes with sub-terminal centromeres than is the case in the present paper. It should, however, be borne in mind that in both cases the material investigated has probably been in cultivation for many generations, which might be responsible for structural changes in the chromosomes.

The trabant, which is clearly visible on chromosome K in both species, is not mentioned by the previous author.

In connection with the recently described species, *C. caulescens*, this is probably the first time it has been investigated cytologically.

The chromosomes of this species show a high degree of correspondence with those of *C. miniata*. The main differences are in the E and J chromosomes. In *C. caulescens* no chromosome was observed to correspond with the E chromosome of *C. miniata*, the latter possessing a submedian kinetic constriction. Chromosome J of *C. miniata* is very similar to the H chromosome of *C. caulescens*. If the positions of chromosomes H and J of *C. miniata* are changed about, the correspondence of the two complexes becomes even greater. It may well be that chromosome J of *C. miniata* is homologous with chromosome H of *C. caulescens*. The 2 SAT chromosomes also appear to be homologous.

3. Genus NERINE

5. *Nerine laticoma* (Ker.) Dur. and Schinz. Plate 3, fig. 4. 2n = 22. Herbarium material: Gouws 77 in UPR.

Genome formula: 1 :lV ; 6 :mf ; 3 :bV ; 1 :bL.

Chromosome A is rendered distinct by its lV shape. The medium chromosomes, B, C, D, E, F and G, are all of the mf type, thus very difficult to identify. Still, B can be identified by having the longest distal arm of the group. C, D and E are about the same length. The proximal arm of C seems slightly shorter than those of the other two. Chromosome F has a shorter distal arm than the previous three, while G, about the

same length as F, has a slightly longer proximal arm. Of the three bV chromosomes, L is rendered distinct by its being the shortest of the three, while H and J resemble each other too closely for optical identification. K is the only bL type and thus distinct.

6. *Nerine duparquetiana* Bkr. Plate 3, fig. 5. 2n = 22. Herbarium material: Gouws 157 in UPR.

Genome formula: 1:lV; 3:mf; 3:mL; 2:bL; 2:bV.

Chromosome A, the only lV type, is quite distinct. Of the mf chromosomes, B, C and G, the former two are about the same length and shape while G can be recognized by its being much shorter than the previous two. Likewise of the D, E and F chromosomes, mL type, F can be identified by its being much shorter than the other two, while these, D and E, are very nearly similar. Of the bL type there seems to be two, H and K. Chromosome H being distinctly longer than K. Chromosomes J and L are also distinguished by the fact that J is longer than K.

7. *Nerine sarniensis* Herb. Plate 3, fig. 6, and Plate 4, fig. 1. 2n = 22 (33). Herbarium material: Gouws 86 in UPR.

Genome formula: 1:lV; 4:mf; 2:mL; 3:bV; 1:bf.

Chromsome A, the only lV type, is distinct. The mf chromosomes, B, C, D and E, are very difficult to identify. Their proximal arms are about the same length, while their distal arms form practically a graded series. The two mL chromosomes, F & G, are rendered distinct by the secondary constriction which divides the proximal arm of G into two approximately equal halves. Of the bV chromosomes, H is the longest, while the other two, K and L, are indistinguishable. Chromosome J, the only bf type, can be readily identified.

8. *Nerine falcata* Bkr. Figure 9–(922). 2n = 22. Herbarium material: Gouws 193, 292, 293, 312 and 314 in UPR.

Genome formula: 1:lV; 2:mL; 3:mf; 1:mV; 2:bf; 2:bV.

A, the lV chromosome, is distinct. The two mL chromosomes, B and G, are easily identified by the fact that B is much longer than G. Of the three mf chromosomes C and D are practically identical while F seems to have a slightly shorter distal arm. Chromosome E, being the only mV type, is distinct. Of the bf chromosomes J has a decidedly shorter proximal arm than H. The bV chromosomes, K and L, are too similar for optical identification.

9. *Nerine frithii* L. Bolus. Plate 4, fig. 2. 2n = 22. Herbarium material: Gouws 204 in UPR.

Genome formula: 1 : lV : 3:lF; 1:mf; 2:mL; 4:bV.

The lV form of chromosome A renders it distinct. The three lf chromosomes, B, C and D, are very difficult to identify on account of the fact that the proximal arms are about the same length, while the distal arms form almost a graded series. Chromosome E is the only mf type and has an akinetic constriction in the distal arm. Chromosomes F and G are easily identified by the fact that F has the longest proximal arm of the

medium chromosomes, while G has a much shorter proximal arm. Of the four bV chromosomes H and L are the longest and shortest respectively, while J and K appear to be identical.

10. *Nerine filifolia* Bkr. Plate 4, fig. 3. 2n = 24. Herbarium material: Gouws 216, 217 and 218.

Genome formula: 1 :lV ; 5 :mL ; 4 :bV ; 2 :bL.

Chromosome A is the only lV type. Of the mL chromosomes E can be identified by the secondary constriction in the distal arm; B is the longest; F is the shortest; while C and D are practically similar. Of the bV chromosomes, G can be distinguished by the fact that it is the longest, while the other three differ too slightly for optical identification. The bL chromosomes, J and M, can be distinguished by the fact that J is appreciably longer than M.

11. *Nerine masonorum* L. Bolus. Plate 4, fig. 4. 2n = 24. Herbarium material: Gouws 222, 223 and 224.

Genome formula: 1 :lL; 4 :mf ; 2 :mL ; 2 :bL ; 3 :bV.

A, the only lL chromosome, is distinct. Of the mf chromosomes, B has the longest proximal arm and is thus distinct. C, D and E have about the same length of proximal arm, while the distal arms form practically a graded series. Identification is thus extremely difficult and even doubtful. F and G, the two mL chromosomes, are distinct on account of the fact that G has an akinetic constriction in the distal arm. H and J, the bL chromosomes, are too similar for optical identification. The bV chromosomes, K, L and M, also resemble each other too closely for optical identification.

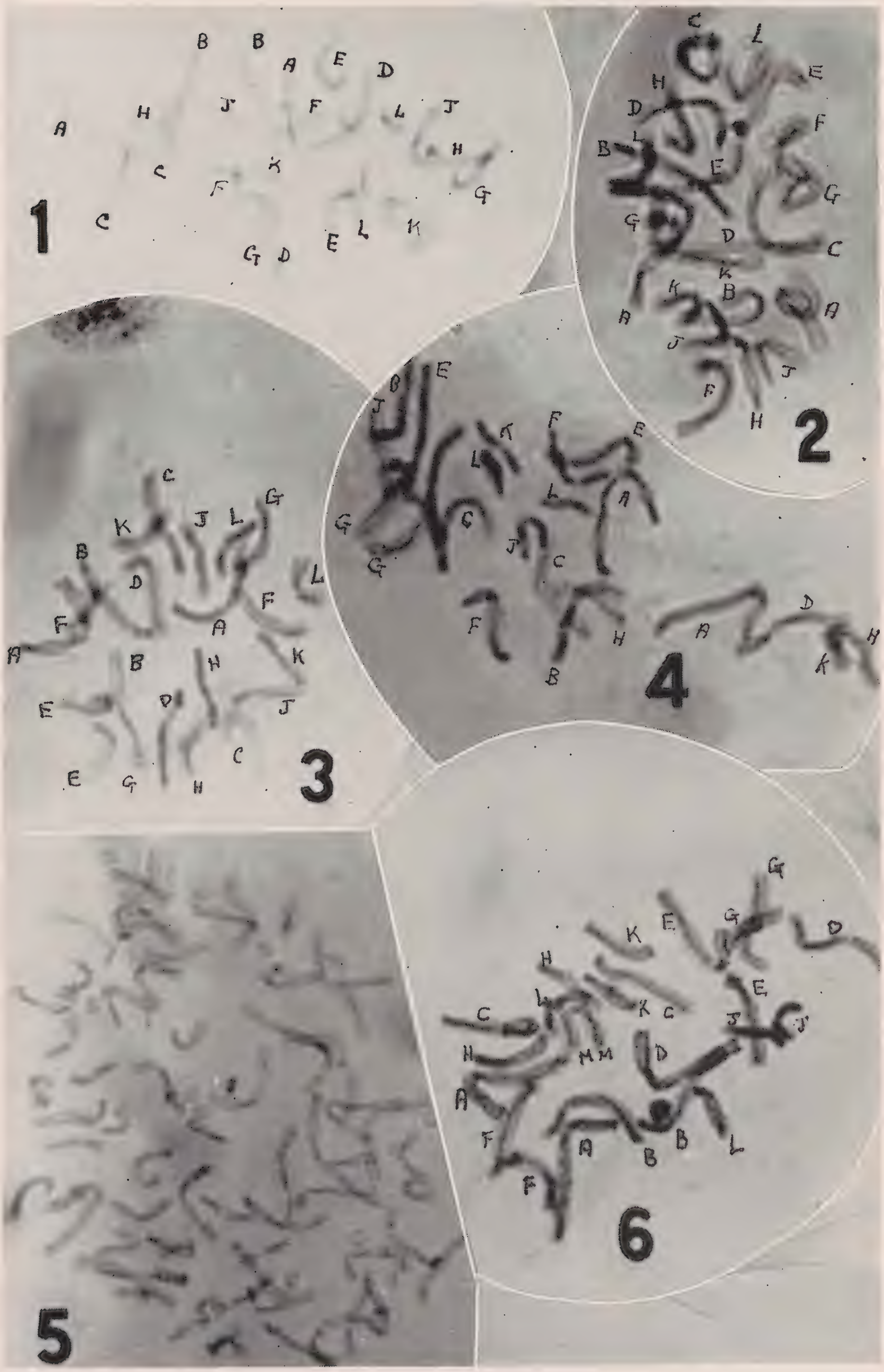
Apparently *N. laticoma, N. duparquetiana, N. frithii* and *N. masonorum* have been investigated cytologically for the first time.

For *N. sarniensis* Heitz (*13*) found 22 (*24*) somatic chromosomes; Inariyama (*8*) reported 33; while James and Addicot (*14*) counted 22 somatic chromosomes. In the present study quite a number of plants, all found growing wild, were investigated. Except for one triploid (see plate 4, fig. 1), all plants were found to have 22 somatic chromosomes.

The counts of James and Addicot (*14*) for *N. falcata* and *N. filifolia* were corroborated here.

There is a great degree of similarity between the karyotypes of the different species. Chromosome A seems to be mostly V shaped, *N. masonorum* being the only exception in this respect. The medium and short chromosomes also exhibit marked similarities both in regard to their number and morphology.

In the two species with 2n = 24, the addition seems to have occurred in the short chromosomes. As Darlington (*5*) has shown, the short chromosomes are more subject to variation than the long ones. The 5 pairs of short chromosomes in these two species (*N. filifolia* and *N. masonorum*) seem to corroborate this statement.



Amaryllid chromosomes—1, *Crinum forbesianum;* 2, *Crinum sp.;* 3, *C. crispum;* 4, *C. buphanoides;* 5, *C. bulbispermum;* 6, *Cryptostephanus vansonii.* (See text for magnification.)

Plate 5

4. Genus COBURGIA Herb. 1819*

12. **Coburgia rosea** (Lamarck) Gouws, **comb. nov.*** [syn.—*Amaryllis rosea* Lamarck, Encyc. Méth. Bot. 1:122. 1783; *Amaryllis belladonna* L'Hérit., Sert. Angl. 11–13. 1788, non Linn.; *Amaryllis belladonna* Ait., Hort. Kew. 1:417. 1789, non Linn.; *Coburgia belladonna* Herb., Bot. Mag. Lond. 47: pl. 2113, p. 4. 1819; *Amaryllis belladonna* Herb., Append. Bot. Reg. 31, 1821, non Linn.; *Callicore rosea* (Lamarck) Link, Handb. 1:193. 1829; *Amaryllis belladonna* Baker, Amaryll. 95. 1888; Fl. Capensis 6:203. 1896, non Linn.; *Brunsvigia rosea* (Lamarck) Hannibal, in Herbertia 9(1942):101-102, 146. 1943.]

For discussions of the nomenclature of this plant the reader is referred to the authorities quoted (*15, 16, 17, 18, 19, 20a, 20b*) at the end of this article.

Plate 4, fig. 5. 2n = 22. Herbarium material: Gouws 182 in UPR.

Genome formula: 3:lL; 2:mf; 2:mL; 1:mV; 2:bL; 1:bV.

A, B and C, the three lL chromosomes, are readily identified by the fact that A has the longest proximal arm; B the shortest proximal arm; and C the shortest distal arm of the three. D and E, the mf chromosomes, are too similar for optical identification. F and G, the mL chromosomes, are readily identified by the fact that G has a secondary constriction in the proximal arm. Chromosome H is the only mV type, thus distinct. J and L, the bL chromosomes, are too similar to be distinguished. K is the only bV chromosome, therefore quite distinct.

According to Baker (*20b*) the genus is monotypic. Cytological reference to this species is made by Flory and Yarnell (*10*), according to whom *Coburgia rosea* Gouws (syn.—*Amaryllis belladonna* Herb., non Linn.) has 2n = 20 as reported by Fernandes (*21*). Fernandes (*22*) again gives *Coburgia rosea* Gouws as 2n = 20. Inariyama (*8*), however, found that *Coburgia rosea* Gouws has 2n = 22. In the present investigation both metaphase and anaphase figures have shown that *Coburgia rosea* Gouws has 2n = 22. As regards the morphology of the chromosomes there are, however, a few important differences with the findings of Inariyama. In the first place, no long chromosome with extremely sub-terminal to terminal kinetochore could be found in this investigation.

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*EDITORIAL NOTE.—The determination of generic limits is in the field of biological research, and rules of nomenclature (which are merely tools) are only obligatory in so far as the use of the first validly published names are concerned. This safeguard is necessary in order to keep research entirely free from dictation. Dr. Gouws is therefore entitled to maintain *Coburgia rosea* (Lamarck) Gouws as the type of the nomenclatural genus *Coburgia* Herb. 1819. *He does this however entirely on his own responsibility* and this does not change the editorial policy in Herbertia of recognizing *Brunsvigia rosea* (Lamarck) Hannibal as the closest approximation of the biological facts when the *Amaryllidaceae* as a whole are taken into consideration as pointed out by Traub & Moldenke, page 65, Amaryllidaceae: Tribe Amaryllеae. 1949. This viewpoint is also accepted in Bailey's Manual of Cultivated Plants. 1949. (See also Gentes Herbarum, Vol. 8, fasc. 1. May, 1949.). The readers should note that fortunately the controversy has been entirely resolved on the rules level because the International Rules of Botanical Nomenclature are impartially observed in both cases. The difference of opinion is on the research level (biological) as it should be. Both sides of all research matters are presented in Herbertia so that workers can form their own opinions.

The three longest pairs of chromosomes have clearly submedian constrictions. Chromosome E, which has the shortest proximal arm, clearly has a sub-terminal constriction.

Sato (*3*), as quoted by Darlington and Ammal (*4*) also found 22 somatic chromosomes for *Coburgia rosea* Gouws.

5. Genus BRUNSVIGIA

Apparently this is the first time a species of this genus has been investigated cytologically. No literature referring to its chromosomes could be traced.

13. *Brunsvigia cooperi* Bkr. Figure 9–(871). 2n = 22. Herbarium material: Gouws 290 in UPR.

Genome formula: 1:lL; 3:mf; 4:mL; 2:bV; 1:bL.

Chromosome A, being the only lL type, is quite distinct. The seven medium chromosomes, however, give much difficulty with their identification. B, C and D are here regarded as mf chromosomes, while E, F, G and H are mL type. The line between the two groups, however, had to be drawn arbitrarily as there is a gradual transition between the two groups. The three mf chromosomes are readily identified by the fact that the proximal arm of C is the longest, while that of B is intermediate in length and that of D is the shortest. Of the four mL chromosomes, E and F are so similar that identification is dubious. G and H with their shorter distal arms, however, can be identified by the fact that G has a longer proximal arm than H. J and K, the two bV chromosomes, are almost identical. L, the only bL chromosome, is distinct.

6. Genus VALLOTA

14. *Vallota speciosa* (Linn. f.) Dur. Schinz. Figure 9–(734). 2n = 16. Herbarium material: Gouws 255 in UPR.

Genome formula: 3:lV; 1:lL; 1:bL; 2:bV; 1:bf.

Chromosomes A, B and D, the lV chromosomes, can be identified by the fact that A is longer than B, which in turn is longer than D. Chromosome C is the only lL type, thus quite distinct. The short chromosomes are distinctly shorter than the long ones, thus forming two clearly defined groups. E is the only bL type, thus quite distinct. Of the two bV chromosomes, F is longer than H, while G is the only f type in the complex.

According to Baker (*20*) the genus *Vallota* is monotypic, but he also makes the following interesting remarks: "Var. *magnifica*, Hort., is a form with large (4 in. long) bright scarlet flowers, with a white eye. Introduced by Mason 1774. There is a white flowered form. *V. elata* Roem. is a form with smaller cherry-red flowers and shorter anthers."

On the same page he also refers to Nos. 5949—2 of Burchell.

It would appear from this citation that Baker had a limited number of samples at his disposal, perhaps too few to enable a good circumscription of the genus. There seems to be a probability that he regarded the genus as monotypic merely on account of a want of a sufficient number

of samples. His remarks concerning a white flowered form, and *V. elata* Roem., with smaller cherry-red flowers, create the impression that the genus may not be monotypic. A revision of the genus in the field seems desirable. The plants here investigated agree very closely with the samples in the National Herbarium, Pretoria, and thus seem to represent typical *V. speciosa* (*V. purpurea*).

Baker's other remark, concerning a large bright scarlet flowered form with a white eye, may be significant. For many years this genus has been cultivated in gardens and is, like *Coburgia* Herb. 1819, occasionally confused with the American genus *Amaryllis* Linn. 1753, non Herb., nec Baker. Bulbs, under the name of *Vallota speciosa,* were received from George, one of the localities cited by Baker. These on flowering proved to be an introduced species of the American genus *Amaryllis* Linn.

According to Darlington and Ammal (*4*) *V. speciosa* has 2n = 16. Thornton (*9*) is quoted as the author who investigated this species.

The most obvious characteristic of the chromosomes of this species is the large percentage possessing sub-median to almost median kinetic constrictions. In this respect they differ from those of all the other plants here investigated.

7. Genus ANOIGANTHUS

Only one species of this genus was obtained and no literature could be traced on the cytology of the genus. Presumably this is the first cytological investigation on the genus.

15. *Anoiganthus breviflorus* Herb. Plate 4, fig. 6. 2n = 16. Herbarium material: Gouws 294 in UPR.

Genome formula: 1:lV; 2:mL; 3:bf; 1:bL; 1:bV.

Chromosome A, being the only lV type, is distinct. The two mL chromosomes, B and C, resemble each other too closely for optical identification. D, E and H, the three bf chromosomes, are readily recognized by the fact that the proximal arm of D is slightly longer than that of E, while no constriction could be observed in the case of H. The assumption is that it has a terminal centromere. Chromosome F, the only bL type, has an akinetic constriction in the distal arm. It is thus readily recognized. Chromosome G is the only bV type, thus also distinct.

8. Genus CRINUM

16. *Crinum forbesianum* Herb. Plate 5, fig. 1; Figure 10–(688). 2n = 22. Herbarium material: Gouws 145 in UPR.

Genome formula: 1:lL; 5:mL; 1:mf; 3:bV; 1:bl.

Chromosome A, lL type, is rendered distinct by its long proximal arm. Of the mL chromosomes B has the longest distal arm, that of C is intermediate, while those of D and E are too similar for optical identification. Chromosome F has an akinetic constriction in its distal arm; it is thus quite distinct. Chromosome G is the only mf type, thus also dis-

tinct. The three bV chromosomes are rendered distinct by the fact that H is longer than J, which in turn is longer than K. Chromosome L is the only bL chromosome.

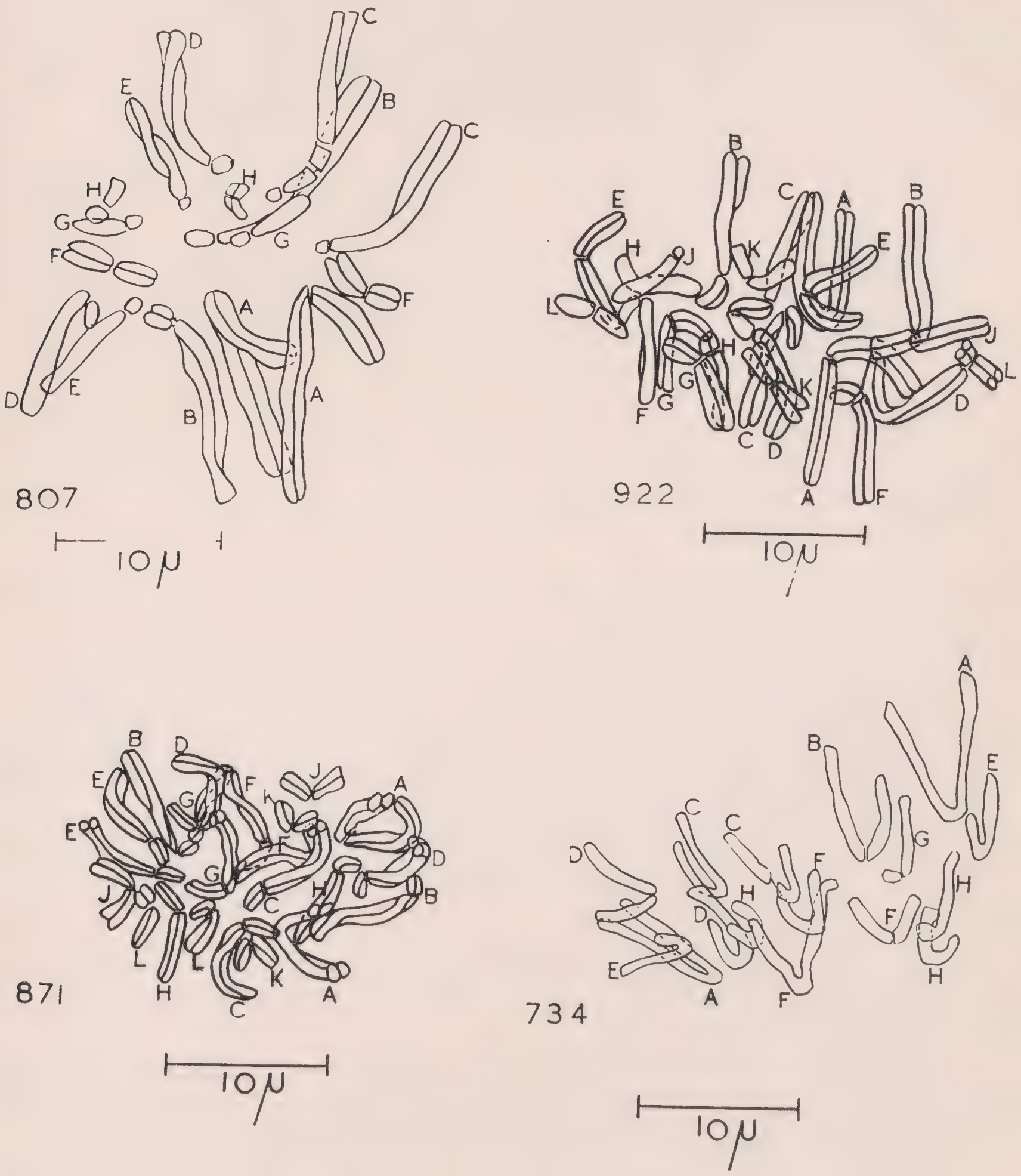


Fig. 9. Amaryllid chromosomes—(807), *Haemanthus nelsoni;* (922), *Nerine falcata;* (871), *Brunsvigia cooperi;* (734), *Vallota speciosa.*

17. *Crinum Sp.* (Probably *C. Sp. nov.*). Plate 5, fig. 2. 2n = 22. Herbarium material: Gouws 159 in UPR.

Genome formula: 1:lL; 5:mL; 1:mf; 1:bL; 3:bV.

Chromosome A is readily recognized by its lL form. The five mL chromosomes, B, C, D, F and G, show a fair degree of variation. B and C correspond too closely for optical identification. D has a shorter proximal arm and slightly longer distal arm than the previous two. F has a shorter proximal arm than the afore-mentioned three, while the proximal arm of G is about the same length as that of D. It can, however, be identified by its much shorter distal arm. Chromosome E is the only mf type. Chromosome H, the only bL type, is quite distinct. The three bV chromosomes, J, K and L, are too similar for optical identification.

18. *Crinum crispum* Phillips. Plate 5, fig. 3. 2n = 22. Herbarium material: Gouws 322 in UPR.

Genome formula: 1:lV; 3:mL; 4:mf; 2:bL; 1:bV.

Chromosome A is the only lV type. Of the three mL chromosomes, B is distinguished by the fact that it has the longest distal arm of the complex. C and D differ too slightly for optical identification. E, F, G and H, the mf chromosomes, are recognized as a group by the fact that they have the shortest proximal arms of the complex. The proximal arms form more or less a graded series while there is also little variation in the distal arms. Optical identification is thus unreliable. The two bL chromosomes can be distinguished by the fact that L is shorter than J. Chromosome K, being the only bV type, is also distinct.

19. *Crinum buphanoides* Bkr. Plate 5, fig. 4. 2n = 22. Herbarium material: Gouws 138 in UPR.

Genome formula: 1:lL; 4:mL; 2:mf; 2:bL; 2:bV.

Chromosome A, the only lL type, is distinct. Of the mL chromosomes, B has the longest proximal arms; F has an akinetic constriction in the distal arm; while C and D (just shorter than B) resemble each other rather closely. E and G, the mf chromosomes, also resemble each other so closely that optical identification is doubtful. The two bL chromosomes can be identified by the fact that H is appreciably longer than J. K and L, the two bV chromosomes, are too similar for optical identification.

20. *Crinum bulbispermum* (Burm.) M–R. and Schw. (?). Plate 5, fig. 5. 2n = 72. Herbarium material: Gouws 130, 133, 134, 135 and 147 in UPR.

The analysis of this complex is very difficult on account of the high number of chromosomes. From a large number of preparations only two figures were obtained from which the number could be obtained with certainty—the first (Plate 5, fig. 5) in full metaphase, while the second was an anaphase. Both showed that the plant has 72 somatic chromosomes. For the analysis of such a large complex one metaphase figure is insufficient. An attempt was made to arrange the chromosomes into groups as far as this is optically possible. There are, however, some chromosomes that form graded series. The extremes of these series are clearly different, but the limits of each group could not be determined with certainty.

In the following formula the figures imply groups: 1:lL; 4:mL; 2:mf; 3:bL; 4:bV.

The 4 chromosomes of group A are readily recognized by their lL form. Groups B, C, D and F are all mL type. The two in group B have the longest distal arms of the medium chromosomes. The next 16 chromosomes show a degree of variation, but so slight that the limits of the different groups could not be determined with any degree of certainty.

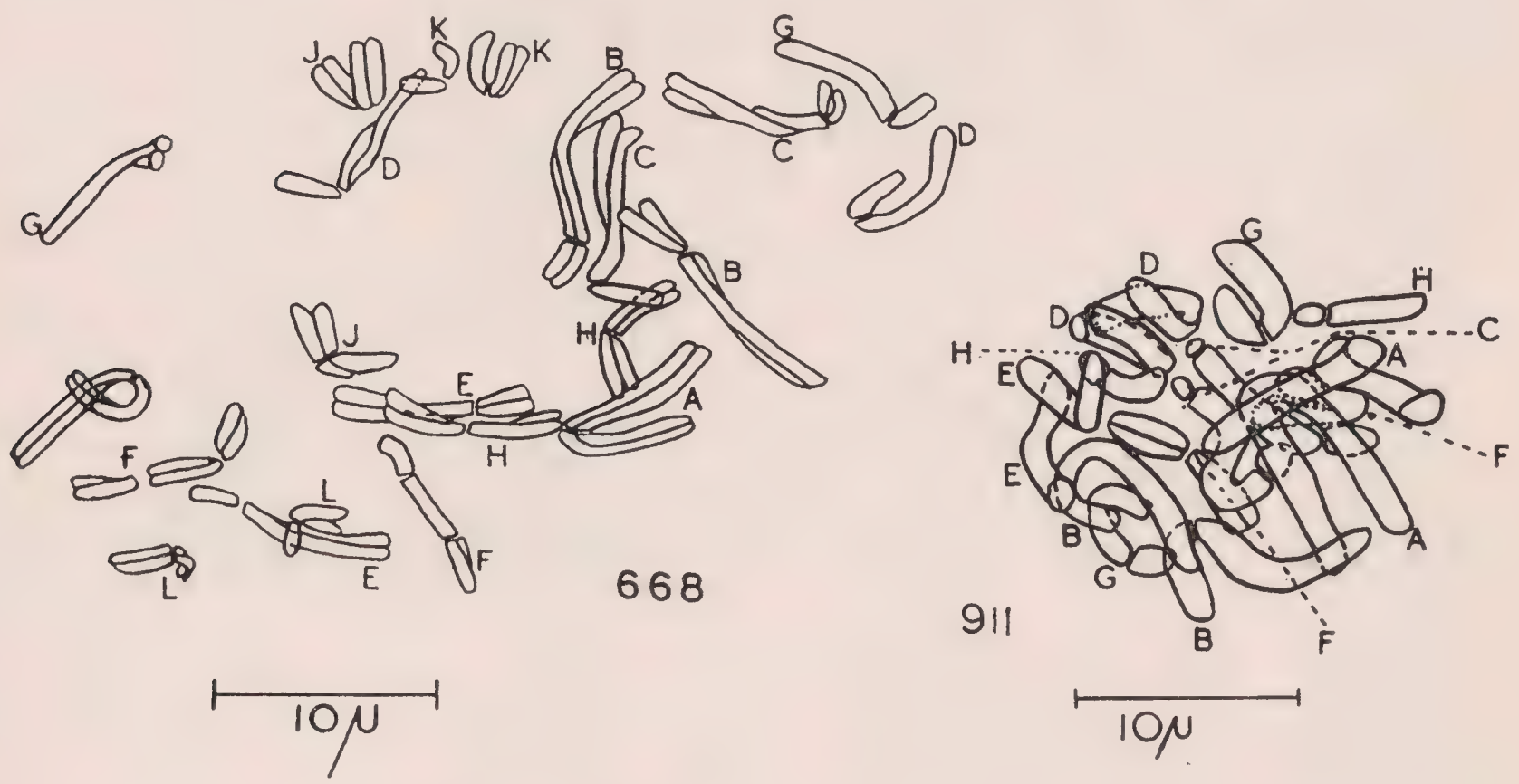
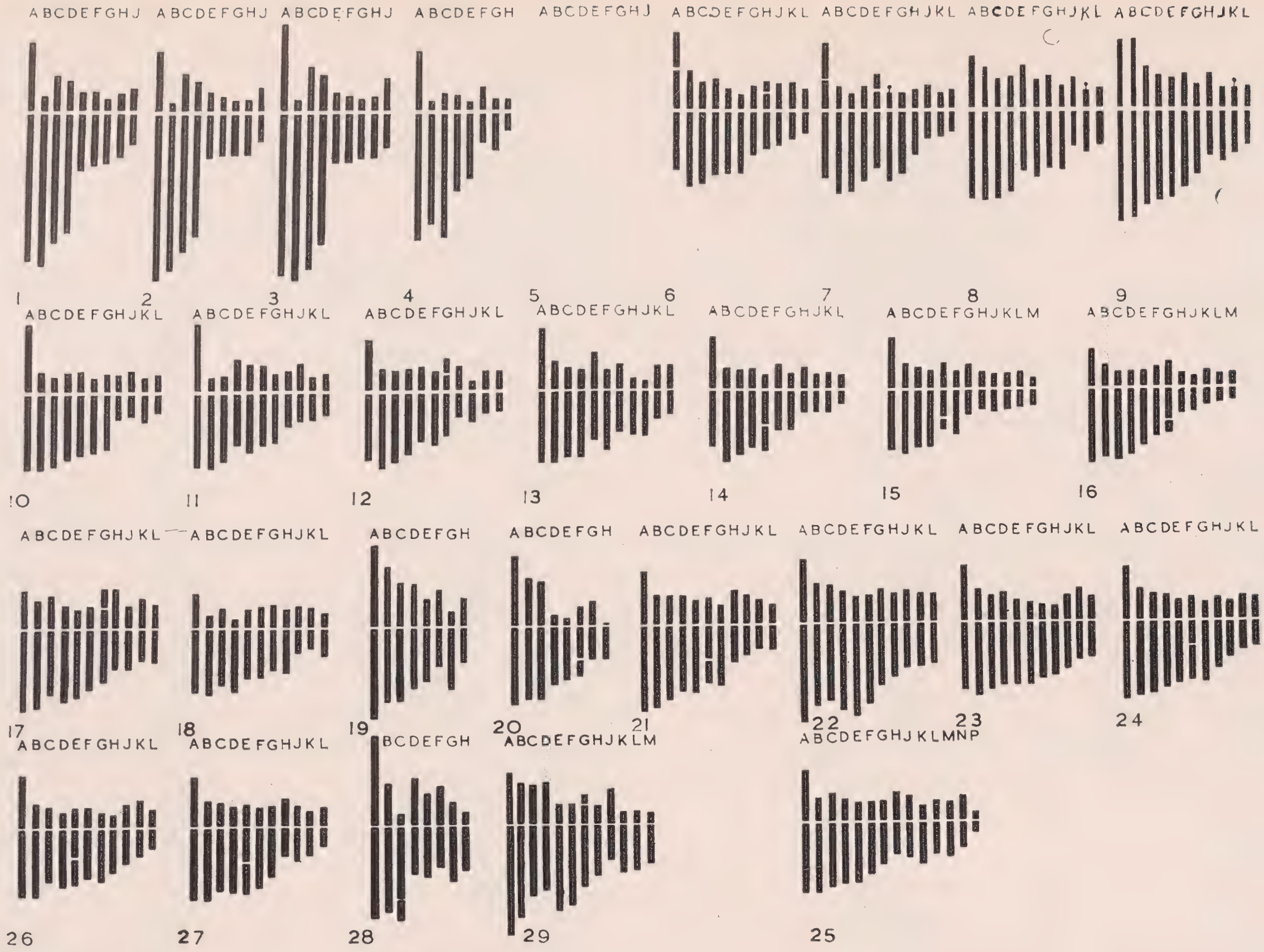


Fig. 10. Amaryllid chromosomes—(668), *Crinum forbesianum;* (911), *Cyrtanthus tuckii* var. *transvaalensis;* (49), *Ammocharis coranica;* (876), *Cybistetes longifolia.*

It seems the most likely limit divides them into two groups of 8 each. Those of group D having slightly longer proximal arms than those of E. The D chromosomes are here regarded as mL type while the E chromosomes are regarded as mf type. It must, however, be borne in mind that the constrictions lie very close to the margin between L and f. Of the F chromosomes (mf type) there also seem to be 8. Their distal arms are



Comparison of amaryllid chromosome complements.

Plate 6 (See opposite page for species legend.)

distinctly shorter than those of the E type, with about the same length of proximal arm. In group G (mL type) there are four with distinctly shorter distal arms than those in group F. Of the bV chromosomes there are four groups: H, J, N and P, with 6, 8, 8 and 4 chromosomes in each group respectively. Those in group H seem to be slightly longer than those in group J, which in turn are slightly longer than those in group N, while the four in group P are almost fragmentary. K, L and M, the bL groups, have 2 chromosomes in each group. The K chromosomes have the shortest proximal arms, while the L chromosomes have the shortest distal arms. The distal arms of chromosomes M seem to be in between those of K and L.

It is obvious that this grouping can only be regarded as tentative. Statistical analysis of a large number of figures will probably change it considerably.

In fertility the plants seem to behave as functional diploids.

The specimens that were identified as *Crinum bulbispermum* were all collected in areas in the Northern Transvaal with a fairly high precipitation. In the adjoining arid areas, however, only *C. forbesianum* is met with.

The areas cited by Baker (*20*), being mostly arid, do not correspond in climate to those mentioned above.

Another striking point is the fact that the polyploid in this case occupies the areas with the most favorable conditions for growth (high precipitation and temperature), while the diploids occur over wide and less favorable arid areas.

Hagerup (*23* and *24*) found that the polyploid usually occupies the larger area under more trying conditions. Baldwin (*25*) came to the same conclusion after a study of *Sedum ternatum*. Hagerup (*24*), however, pointed out that vivipary increases with ploidy up to a certain maximum. This may also be true of its distribution.

Inariyama (*8*) reported 22 + 2f chromosomes for *C. capense* (*longifolium*) of India. It is to be doubted whether this species is conspecific with the South African *C. bulbispermum* (*longifolium*). It must also be borne in mind that the limits of the South African species of this genus are as yet very poorly defined and it may be that the plants here investigated do not represent typical *C. bulbispermum* (*longifolium*) as reported by Baker to have been collected at Cape Town, Cathcart, Colesberg, Hopetown, etc.

This is probably the first time polyploidy has been observed within the genus *Crinum*.

Plate 6 (See opposite page). Comparison of amaryllid chromosome complements: 1, 2 & 3, *Haemanthus magnificus;* 4, *H. nelsoni;* 6, *Boöphone disticha;* 7, *B. guttata;* 8, *Clivia miniata;* 9, *C. caulescens;* 10, *Nerine laticoma;* 11, *N. duparquetiana;* 12, *N. sarniensis;* 13, *N. falcata;* 14, *N. frithii;* 15, *N. filifolia;* 16, *N. masonorum;* 17, *Coburgia rosea;* 18, *Brunsvigia Cooperi;* 19, *Vallota speciosa;* 20, *Anoiganthus breviflorus;* 21, *Crinum forbesianum;* 22, *C. Sp. n.;* 23, *C. crispum;* 24, *C. buphanoides;* 25, *C. bulbispermum;* 26, *Ammocharis coranica;* 27, *Cybistetes longifolia;* 28, *Cyrtanthus tuckii* var. *transvaalensis;* 29, *Cryptostephanus vansonii.*

The plants obtained from Potchefstroom and Bloemfontein have chromosomes morphologically rather different from those of *C. forbesianum,* under which category the plants just mentioned have been classified up to the present. Yet these differences seem to plead for the creation of a new species. From a discussion of this point with Miss I. C. Verdoorn of the National Herbarium, Pretoria, it appeared that she had already arrived at the same conclusion after an organographic study of plants collected in approximately the same areas.

9 and 10. Genera AMMOCHARIS and CYBISTETES

21. *Ammocharis coranica* (Ker-Gawl.) Herb. Figure 10–(49). 2n = 22. Herbarium material: Gouws 1 and 7 in UPR.

Genome formula: 1:lL; 3: mL; 4:mf; 1:bL; 2:bV.

Chromosome A is readily recognized by its lL form. The mL chromosomes B, C and F can be identified by the fact that B has the longest proximal and distal arms, while the distal arm of F is only slightly shorter than that of C. Of the four mf chromosomes, D and G are practically identical; E has the shortest proximal arm of the group; while the akinetic constriction in the distal arm of C renders it distinct. J, the bL chromosome, is distinct. K and L, the two bV chromosomes, can be distinguished by the fact that K is a distinctly larger V than L.

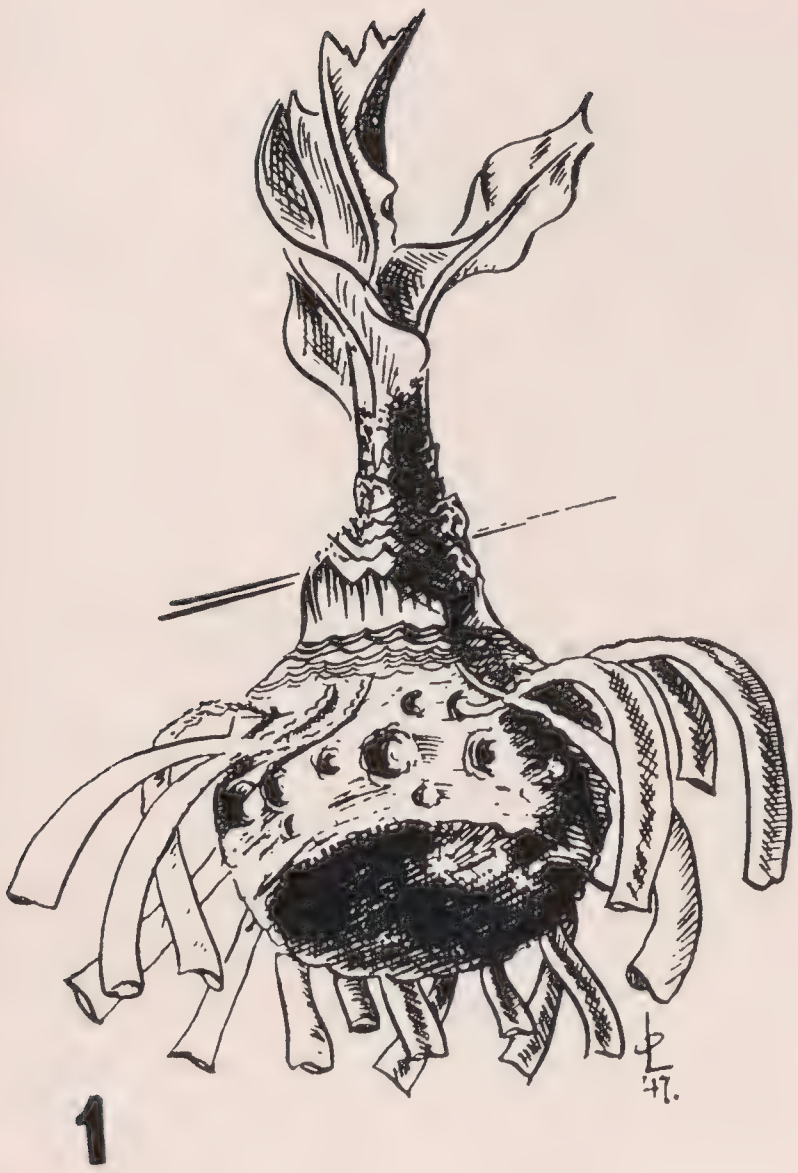
22. *Cybistetes longifolia* (Linn.) M–R. and Schw. Figure 10–(876). 2n = 22. Herbarium material: Gouws 28 in UPR.

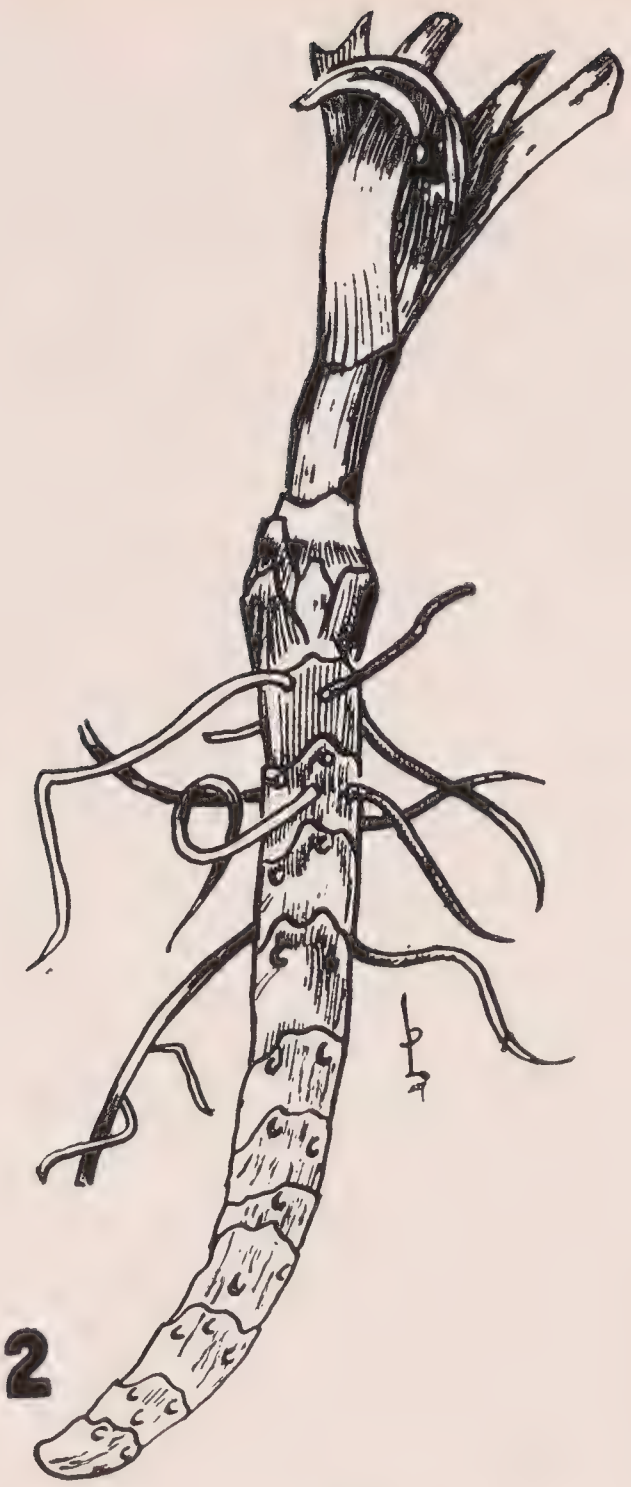
Genome formula: 1:lL; 4:mL; 2:mf; 2:bV; 2:bL.

Chromosome A, being the only lL type, is readily recognized. The medium chromosomes show a gradation very much like that in *Ammocharis coranica.* B, C, E and G are here regarded as mL chromosomes, while D and F are mf chromosomes. B can be identified with a fair degree of certainty by the fact that its distal arm equals that of A. Chromosome E has an akinetic constriction in the distal arm, while G is rendered distinct by the fact that it has the shortest distal arm of the medium chromosomes. Of the bV chromosomes H is distinctly longer than L. The two bL chromosomes can be distinguished on account of the proximal arm of K being shorter than that of J.

The genus *Ammocharis* was revised by Milne-Redhead and Schweickerdt (*26*), so that there is no difficulty in the identification of these plants. On the difference of its fruit with the other species of *Ammocharis,* the plant formerly known as *A. falcata* (Jacq.) Herb. alias *A. longifolia* (Linn.) Roem., was transferred to the newly created genus *Cybistetes* M–R. & Schw. On page 191 of their publication they make the following remark: "It is probable, therefore, that *Cybistetes* is more closely related to *Ammocharis* than to any other genus."

The number and morphology of the chromosomes of the two plants in question were investigated and the results obtained corroborate this remark completely. Plate 6 shows the striking similarity between the two complexes. It is, however, impossible to decide from purely cytological data whether the two species belong to the same or different genera.





Rootstocks—1, *Haemanthus magnificus;* 2, *Clivia caulescens;* 3, *Hypoxis sp.;* 4, *Boöphone disticha.*

Plate 7

11. Genus CYRTANTHUS

23. *Cyrtanthus tuckii* Bkr. var. *transvaalensis* Verdoorn. Figure 10–(911). 2n = 16. Herbarium material: Gouws 287 and 289 in UPR.

Genome formula: 1 :lV ; 1 :lL ; 1 :lf ; 2 :mV ; 2 :mL ; 1 :bf.

Chromosomes A, B and C, being lV, lL and lf chromosomes respectively, are readily recognized. Chromosome C is further distinguished by the akinetic constriction in the distal arm. The mV chromosomes, D and F, are readily distinguished by the fact that D is longer than F. E and G, the mL chromosomes can be identified by the proximal arm of E being longer than that of G. Chromosome H is the only bf type, hence distinct.

Darlington and Ammal (*4*) give the somatic chromosome number of *Cyrtanthus obliquus* as 22. Randolph Taylor (*27*), however, reports 2n = 16 for *C. parviflorus* Bkr. This is also the number found in the present investigation for *C. tuckii* var. *transvaalensis*. His interesting remark that the complex is "... . difficult to analyze because of the length and tangled character of the elements" was found to be true also for the chromosomes of the species here described. His fig. 32 shows a great degree of resemblance with Figure 10–(911) of the present paper. The most important differences are in the long chromosomes: Where Taylor observed two pairs of V's and two pairs of chromosomes with secondary constrictions, only one pair of long V's and one pair with secondary constrictions were observed in the present investigation.

12. Genus CRYPTOSTEPHANUS

24. *Cryptostephanus vansonii* Verdoorn. Plate 5, fig. 6. 2n = 24. Herbarium material: Gouws 311 in UPR.

Genome formula: 2 :lL ; 3 :mL ; 2 :mf ; 1 :bL ; 1 :bV ; 3 :bf.

The lL chromosomes are rendered distinct by A being longer than B. Of the mL chromosomes G is recognized by the akinetic constriction in its proximal arm, while C and D resemble each other too closely for optical identification. Similarly E and F, the mf chromosomes, cannot be distinguished optically. H and J, the bL and bV chromosomes respectively are distinct. K, L and M, the bf chromosomes, show a certain degree of variation, but insufficient for optical identification.

Although this genus does not belong to the *Amaryllideae* it has been included here because of its close resemblance in habit to that of the genus *Clivia*. As nos. 8, 9 and 29 of Plate 6 (*Clivia miniata, C. caulescens* and *Cryptostephanus vansonii* resp.) show, there are numerical and morphological differences. Still there is a marked degree of resemblance too. This will be referred to later.

Apparently this is the first time the genus has been investigated cytologically.

IV. DISCUSSION

The method for the construction of Plate 6 has previously been discussed. It is only necessary to repeat that the classification of Pax and

Hoffmann in Engler and Prantl (*28*) has been followed since this at present still is the most complete system.

In the classifications of Rendle (*29*), Hitchcock (*30*), Thonner (*31*) and Phillips (*32*) the underlying principles are similar.

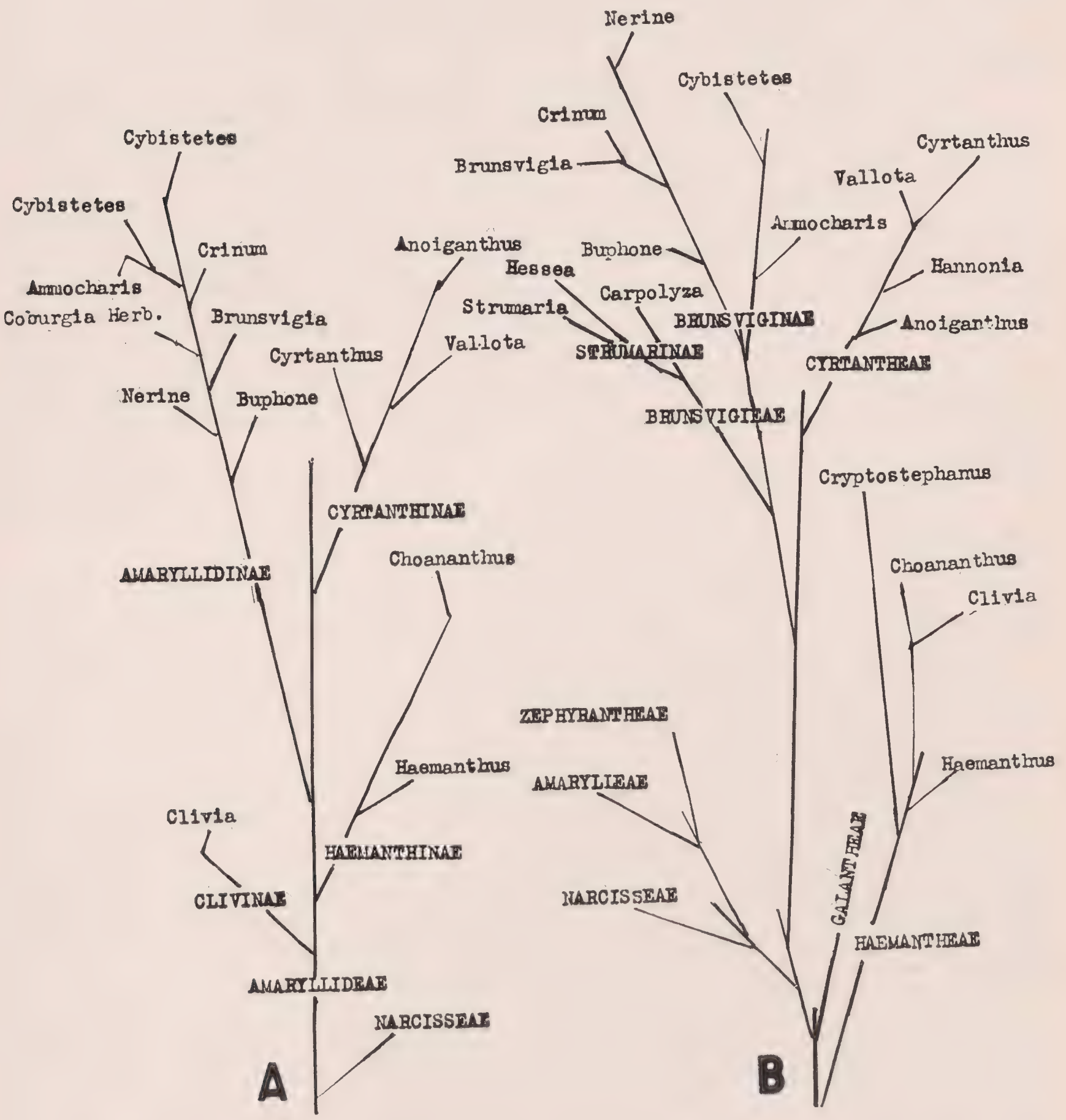


Fig. 11. Probable phylogeny of amaryllid groups,—A, according to Gouws (present work); and B, according to Traub (unpublished manuscript: AMARYLLIDACEAE, as of 1949).

On comparing the probable phylogeny as presented in the classifications of Engler and Prantl (*28*) and Hutchinson (*33*) it appears that:

1. The main branch, i.e., the tribe *Amaryllideae* of Pax and Hoffmann, is unnamed by Hutchinson.

2. The sub-tribes *Amaryllidinae, Crininae* and *Haemanthinae* of Pax and Hoffmann are raised to the ranks of tribes by Hutchinson viz. *Amaryllideae, Crineae* and *Haemantheae.*

3. *Vallota* has been transferred by Hutchinson to the *Crineae.*

4. *Anoiganthus* is omitted by Hutchinson. (One realizes, however, that his system does not claim to be complete in every detail).

5. The *Amaryllideae* and *Crineae,* in Hutchinson's classification, overlap to a small degree.

This overlapping suggests a very close affinity between a branch of the *Crineae* (being composed of the genera *Crinum, Coburgia* and *Ammocharis*) and the *Amaryllideae,* a point to be referred to later.

In a publication on the genus *Choananthus* Milne-Redhead (*34*) describes the subterranean organ of this genus as being a root-stock. In the same account the author points out that two types of subterranean organs are met with in the tropical representatives of the genus *Haemanthus:* the first type consisting of a group of species possessing a rhizome from the apex of which a bulb arises which in turn is composed of the expanded bases of the petioles surrounded by a few sheathing scales; the second type consisting of a group of species where bulblike organs are absent.

Milne-Redhead, furthermore, was able to correlate a terminal scape with the subterranean organ of the second type. In addition hereto he mentions differences in the nature of the perianth.

According to Hugo de Vries (*35*), a rootstock is a horizontal or vertical subterranean stem which decays from the base upwards.

This definition being accepted, the subterranean organs of plants such as *Haemanthus magnificus* and *Clivia caulescens* (Plate 7, figs. 1 and 2) may also be considered rootstocks. In the case of *Haemanthus hirsutus* the organ in question is decidedly a bulb, whereas this is not clearly so in the case of *H. magnificus.* The resemblance between the subterranean organs of the latter species with those of the genus *Hypoxis* e.g. *H. cooperi* as described by Pole Evans (*36*), (see Plate 7, fig. 3) is striking. In both cases there is below the roots an older portion of the succulent stem, devoid of tunics, which progressively decays from the base upwards. There are indeed a number of tunics above the roots of *Haemanthus magnificus* by which the organ probably is regarded as a bulb. Above the roots of *Hypoxis,* on the other hand, the remains of the partially decayed old leaf sheaths are present in the form of fibres called bristles by Pole Evans (*36*). On removing these fibres, the leaf sheaths of the subsequent year's growth become evident. There is, therefore, no fundamental difference between the subterranean organs of the two plants. It is also clear that in the species of one and the same genus (*Haemanthus*) two distinct types of subterranean organs are met with. To use a character which is unstable even in one and the same genus, for the identification of sub-families, savors of the artificial.

In the case of *Clivia caulescens* (Plate 7, fig. 2) the bulb is even less evident. Yet *Clivia* and *Haemanthus* are grouped together with *Boöphone* (with a definite bulb, see Plate 7, fig. 4) under the *Haemanthinae.* This in spite of the fact that on page 391 Pax and Hoffmann (*28*) state: "The

typical *Amaryllidaceae* are characterized by well-developed bulbs; only in a few genera, as *Haemanthus, Clivia* and especially *Ixiolirion*, is there deviation therefrom, in that among them are found transitional forms with subterranean rhizome or leafy peduncle.''

Of the three species of the genus *Haemanthus* here investigated, *H. magnificus* possesses 18 chromosomes, a phyllotaxis other than ½, leaf-bases simulating an aerial stem, and a subterranean rhizome. In contradistinction hereto both *H. nelsoni* and *H. hirsutus* possess 16 chromosomes, a phyllotaxis of ½, prostrate leaves adpressed to the soil thus not simulating an aerial stem, and furthermore with distinctly bulbous subterranean organs.

The characters enumerated by Milne-Redhead (*34*) may possibly be correlated with those just mentioned, but such a presumption would call for a detailed investigation of all the representatives of the genus, which lies beyond the limits of the present cytological study.

The cytology of *Haemanthus, Boöphone* and *Clivia* (see Plate 6, nos. 1–4; 6 and 7; and 8 and 9 resp.) reveals that the three genera are not so closely related as to allow a grouping within the same sub-tribe.

The genomes of *Clivia* and *Boöphone* bear a greater resemblance to those of the *Amaryllidinae* or *Crininae* than to those of *Haemanthus*. It seems desirable, therefore, that both *Clivia* and *Boöphone* be removed from the *Haemanthinae*.

On comparing the genomes of *Clivia* and *Cryptostephanus*, one is struck by a fair degree of resemblance in their morphology, in spite of the numerical difference. A close relationship is also evident in the organography of the two genera (see description by Verdoorn (*37*)).

It is therefore suggested that a new sub-tribe be created to accommodate the genus *Clivia* and that it should be placed near the base of the phylogenetic tree of the *Amaryllideae* to indicate its relationship with *Cryptostephanus* of the *Narcisseae*. Such a sub-tribe could be called the *Clivinae*.

Careful consideration of Pax and Hoffmann's grouping of the genera exhibiting coronal structures in the flower leads one to suspect that such a grouping is not necessarily one indicative of a natural generic relationship; the genera exhibiting coronal structures thus need not be monophyletic, but may indeed be polyphyletic in origin.

The genus *Boöphone* will be referred to later.

Under the *Amaryllidinae* and *Crininae* there are certain genera which could be grouped more satisfactorily under a separate sub-tribe. The genera concerned are: *Vallota, Anoiganthus* and *Cyrtanthus*. In these the somatic chromosome number is 16 and the genome most probably 8. Although the genome of the genus *Haemanthus* is probably also 8, this genus, however, cannot be grouped with the previous three genera, as both the morphology of the chromosomes and the organography of the plants argue against such a step.

Cytologically, apparently no objection can be raised against the remaining genera of the *Amaryllidinae* and *Crininae* (*Coburgia* Herb. (1819), *Brunsvigia, Nerine, Crinum, Ammocharis* and *Cybistetes*) being

grouped under the same sub-tribe, as is also suggested by the overlapping of the *Crineae* and *Amaryllideae* in the classification of Hutchinson.

Assuming that the allocation of genera by Pax and Hoffmann for the *Amaryllideae* is acceptable, it is suggested that:

1. A new sub-tribe be created to accommodate the genus *Clivia*. As an alternative, *Clivia* and *Cryptostephanus* could be grouped in one and the same sub-tribe.

2. *Boöphone* to be transferred from the *Haemanthinae* to the *Amaryllidinae*.

3. *Vallota, Anoiganthus* and *Cyrtanthus* to be grouped under the *Cyrtanthinae*.

4. *Crinum, Ammocharis* and *Cybistetes* also to be placed under the *Amaryllidinae*, as is also suggested by the overlapping in the classification of Hutchinson (*33*). The phylogenetic tree would then appear as in Figure 11-A. It is interesting to note that Traub (*38*) arrived at much the same conclusions. The only difference being that, as with Huchinson, Traub's tribal concept coincides with the sub-tribes of Pax and Hoffmann. His classification of the *Cyrtantheae* and *Brunsvigieae* (*Amaryllideae*) shows a decided advance on the previous systems.

A comparison with the phylogenetic tree in Figure 11-B [compiled from Traub's classification of the *Amaryllidaceae* (*19, 38, 39*)] clearly shows how close the agreement is with the present suggestions.

Traub's classification of the *Cyrtantheae* and *Brunsvigieae* is in complete harmony with the cytological evidence for the South African genera. Thus far his classification must be regarded as a step forward. By creating a separate tribe *Cliveae*, to accommodate the genus *Clivia*, and perhaps also the genus *Cryptostephanus*, Traub's classification would become a still more natural one.

V. SUMMARY

1. Separate mounting of cover- and objectglass has a decided advantage over a recombination of the two.

2. The following is a list of the investigated species with their somatic chromosome number. The species numbers refer to the numbers in Plate 6. *Boöphone guttata* and *B. disticha* were investigated by Pienaar (unpublished).

Those starred (*) were investigated for the first time.

Name	*2n*	*Area*
HAEMANTHUS		
*1, 2, and 3. *magnificus* Herb.	18	(1) Wakkerstroom, Tvl.; (2) Letaba, Tvl.; (3) Pretoria, Tvl.
*4. *nelsoni* Bkr. (?)	16	Bloemfontein, O.F.S.
*5. *hirsutus* Bkr.	16	Wakkerstroom, Tvl.
BOÖPHONE		
6. *disticha* (Linn. fil.) Herb.	22	Pretoria, Tvl.
7. *guttata* (Linn.) Herb.	22	Stellenbosch, C. Prov.

	CLIVIA		
8.	*miniata* Regel	22	(Cultivated)
*9.	*caulescens* R. A. Dyer	22	Houtbos, Tvl.
	NERINE		
*10.	*laticoma* (Ker.) Dur. and Schinz	22	Bloemfontein, O.F.S.
*11.	*duparquetiana* Bkr.	22	Zoutpansberg, Tvl.
12.	*sarniensis* Herb. (33)	22	Stellenbosch, C. Prov.
13.	*falcata* Bkr.	22	Rustenburg, Tvl.
*14.	*frithii* L. Bolus	22	Potchefstroom, Tvl.
15.	*filifolia* Bkr.	24	(Cultivated), C. Prov.
*16.	*masonorum* L. Bolus	24	(Cultivated), C. Prov.
	COBURGIA Herb. 1819.		
17.	*rosea* (Lamarck) Gouws	22	Stellenbosch, C. Prov.
	BRUNSVIGIA		
*18.	*cooperi* Bkr.	22	Wakkerstroom, Tvl.
	VALLOTA		
19.	*speciosa* (Linn. f.) Dur. Schinz	16	Kirstenbosch, C. Prov.
	ANOIGANTHUS		
*20.	*breviflorus* Herb.	16	Wakkerstroom, Tvl.
	CRINUM		
*21.	*forbesianum* Herb.	22	Bandolierkop, Tvl.
*22.	Sp. n.	22	Bloemfontein, O.F.S.
*23.	*crispum Phillips*	22	Pretoria, Tvl.
*24.	*buphanoides* Bkr.	22	P. P. Rust, Tvl.
*25.	*bulbispermum* (Burm.) M-R. and Schw.	72	Duiwelskloof, Tvl.
	AMMOCHARIS		
*26.	*coranica* (Ker-Gawl.) Herb.	22	Hamanskraal, Tvl.
	CYBISTETES		
*27.	*longifolia* (Linn.) M-R. & Schw.	22	Stellenbosch, C. Prov.
	CYRTANTHUS		
*28.	*tuckii* Bkr. var. *transvaalensis* Verdoorn	16	Wakkerstroom, Tvl.
	CRYPTOSTEPHANUS		
*29.	*vansonii* Verdoorn	24	S. Rhod.

3. The chromosome numbers seem to prove the partial inadequacy of the system of classification of Pax and Hoffmann. It is suggested that the genera *Boöphone, Crinum, Ammocharis* and *Cybistetes* be accommodated in the sub-tribe *Amaryllidinae;* and that two new sub-tribes should be created, one to accommodate the genus *Clivia* and the second for the genera *Vallota, Anoiganthus* and *Cyrtanthus.*

4. The plant, tentatively identified as *Crinum bulbispermum* from the Duiwelskloof area Northern Transvaal, is a polyploid with 72 somatic chromosomes. Its distribution, occurring in areas with a high precipitation only, merits specific rank.

5. The *Amaryllidoideae* cannot be distinguished from the other subfamilies of the *Amaryllidaceae* by the possession of either a bulb or a rhizome. Rhizomes occur in different genera of the *Amaryllideae,* viz.—some species of *Haemanthus, Clivia* and *Choananthus.*

6. *Ammocharis* Herb. and *Cybistetes* M-R. and Schw. are very closely related genera.

7. A provisional phylogenetic tree of the *Amaryllideae* is suggested, based on the results of this study. This differs fundamentally in certain points from the phylogeny of this tribe as set forth by Pax in Engler and Prantl (*28*).

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ALLIUM TRICOCCUM NOTES

THOMAS K. BARRIE, *Pennsylvania*

I have read with great interest the report of Dr. Traub in 1947 HERBERTIA (pages 69-70), and since my interest in this species goes back for some years, I have been watching these plants again during the summer of 1948 in an attempt to answer Dr. Traub's question on page 70.

Two groups of *Allium tricoccum* were studied,—(A) plants growing in their native habitat, and (B) plants under cultivation in my garden. I thought that perhaps the moving of the plants sent to Dr. Traub might have retarded their growth, and also the development of the seeds. However, my analysis for 1948, as shown in Table 1, is about the same as that which he reported. The seeds for 1948 may be a fraction larger. I used a transparent rule held behind the seeds, and a magnifying glass to obtain the measurements.

TABLE 1. *Allium tricoccum*, 1948

Umbel number	Capsule number	Number of capsules with 1 seed	2 seeds	3 seeds	Diameter of seeds range, mm.	average, mm.
		GROUP A. GROWING IN NATIVE HABITAT				
1	1–19	8	11	0	2.5 –3.5	3.33
2	1–13	2	11	0	1.75–4.0	3.46
		GROUP B. CULTIVATED IN GARDEN				
1	1–13	1	9	3	3.0 –3.5	3.45
	14–17	seeds not developed				
2	1–14	5	6	3	3.0 –3.5	3.39
	15–19	seeds not developed				

I have studied several umbels at other points in the County, and in all cases only one or two seeds developed per capsule. *Allium tricoccum* generally grows in clumps. I wonder if this crowding may be the cause of failure of some seed to develop. I plan to separate the bulbs and plant them singly and see what happens.

AMARYLLID NOTES

HAMILTON P. TRAUB, *Maryland*

Amaryllis incarnata Hort. ex Heydt, in Moellers Deutsch. Gaert.-Zeit. 47:304. 1932; Traub and Moldenke, Tribe Amaryll. 1949, p. 137. = *Lycoris incarnata* Comes ex Sprenger.

Crinum bulbispermum (Burm.) M-R. and Schwkt., var. **farinianum** (Baker) Traub, **comb. nov.** Syn—*Crinum longifolium* var. *farinianum* Baker, Gard. Chron. Ser. 2, 16:883. 1887; Amaryll. 94. 1888.

xClivia cl. PRINCE ALBERT, Ch. de Bosschere, L'Illus. Horticole 3: 217, pl. LXII. 1896.

Reported as a cross between *xClivia* cl. MADAME DONNER and *xC.* cl. CHEVALIER HEYNDERYCX. The umbel is many-flowered; the tepalsegs are quite wide; the perigone color is a brilliant scarlet red with prominent yellowish-whitish star in center. Can anyone inform the readers as to what has become of these and other outstandng *Clivia* hybrids?

Zephyranthes chloroleuca Jacques, Ann. Flore et Pomone (Jour. des Jard.) 2:28-29, pl. facing p. 28. 1833. Only a side view is shown, and the description is incomplete. This plant is apparently *Habranthus Andersoni* Herb.—the flower shape and color are similar to this species, and the stigma is indicated as trifid.

Zephyranthes grandiflora Lindl.; Jacques, Ann. Flore et Pomone (Jour. des Jard.) 2:93–94, pl. facing p. 93. 1833. This plate is correctly named.

Crinum minor Jacques, syn. *Amaryllis latifolia* Jacques, Ann. Flore et Pomone (Jour. des Jard.), 59–60. 1833.

Descr.—The bulb is shaped like a large walnut slightly elongated; the leaves are 3–3.5 dm. long, 2.5–3 cm. broad, sheathing at the base, glabrous, apple-green; the scape is produced at the side of the bulb, is nearly round, pale green, about 1.7–2 dm. tall; the spathe is 2-valved, the valves about equal in size; the umbel is 4–5–flowered; the tepaltube of the perigone is about 7.6 cm. long, greenish; the perigone-limb (6 tepalsegs) is about 5 cm. long, of a beautiful white, the tepalsegs slightly undulating, and somewhat recurved at the tips. It flowers in March and April (under culture at Naples).

Notes.—This worker, who signs himself "Jacques," has done a great disservice to science by proposing plant names without adequate descriptions. In this case it will be difficult, if not impossible, to identify this plant. He received it as *Amaryllis latifolia*, which means that it is broad-leaved, but he indicates the breadth of the leaves as 12–15 lines (= 2.5–3 cm.) which hardly measures up to the name.

Amaryllis Jacobaea Karsch, Phan.-Flora Westphalen, p. 814. 1853. = *Sprekelia formosissima* (L.) Herb.

[AMARYLLID NOTES—Hamilton P. Traub, continued on page 50.]

A PINK AMARYLLIS

Mary G. Henry, *Pennsylvania*

A pink *Amaryllis* bloomed in the window of a well known Philadelphia florist in 1944. My daughter Josephine saw it on February 2nd and commented on it. At this season, however, red and occasionally pink *Amaryllis* are seen in florist shops, so I gave but a passing thought to the occurrence and promptly forgot it altogether.

Six days later, on February 8th, I happened to pass the same window when surely the term "rooted to the spot" applied to me.

The pink *Amaryllis* were still there, some half a dozen stalks in a vase. The flowers were a totally different pink from anything I had ever seen in an *Amaryllis*. The pink was a true pink of an exceedingly attractive and luscious shade. There was no tinge of magenta nor any hint of peach to mar the purity of the color.

The errands for which I went to town were forgotten. I acquired two stalks of the *Amaryllis*. There were two flowers on one stalk and three on the other. The well shaped flowers were large but not as large as the florists' hybrids commonly seen, and according to Ridgway the color was close to "Eosine Pink." I guessed the source whence these flowers came, as I knew that one of the officers of the Academy of Natural Sciences had recently been collecting birds in South America. Later on I learned that the bulbs had been collected in Bolivia by a local bird collector. The Philadelphia ornithologist who brought them to the United States does not know if this species has as yet been identified.

My two precious stalks of this *Amaryllis* were kept in their box for five days until February 13th. I used the pollen on several *Amaryllids* then in bloom in my tiny greenhouse, keeping the stalks sprinkled in their narrow box. Suddenly an idea came to me. I placed the two stalks in a vase—there was but one flower remaining apiece—and pollinated each with the other's pollen. This was on February 13th. Slowly one of the pods swelled. As the days passed, the cut end of the stem seemed to melt away. With trepidation I saw the rot creep higher and higher towards the enlarging pod. It was a race.

The seed pod won but the stem had literally rotted away. Just two months after pollination the fat pod split open, exposing the ripe seeds!

The seeds were sown April 18th. Many of them were soft and flabby and soon disintegrated, but roots emerged from a few on April 25th. Two of the tiny bulbs lived to put out leaves on May 18th. One of these grew apace but the other dwindled away.

In February 1948, just about four years after pollination, my one bulb of the precious pink *Amaryllis* sent up a sturdy stalk from which expanded three enchantingly lovely flowers! (Plate 8.)

What a thrill they gave me, and how precious and beautiful they seemed after the long but exciting wait. According to Traub & Moldenke this plant is *Amaryllis belladonna* var. *Haywardii.*

Editorial Note.—The cover design, by Miss Josephine Henry, for 1950 Plant Life, including Herbertia, will feature *Amaryllis belladonna* var. *Haywardii* in color.

AMARYLLID GENERA AND SPECIES

[In this department the descriptions of amaryllid genera and species, particularly recent ones, translated from foreign languages, will be published from time to time so that these will be available to American and British readers.—*Harold N. Moldenke*]

Habranthus teretifolius (C. H. Wright) Traub & Moldenke, in Tribe Amaryll. 145. 1949.

Syn.—*Hippeastrum teretifolium* C. H. Wright, in Gard. Chron. 28(2) :142. 1900; et Bull. Misc. Inf. Kew, 144. 1901; *Hippeastrum teretiflorum* (sphalm.), Index Kewensis, suppl. 2.

Description.—Bulb pyriform, brown; leaves terete, acute, 3.6 dm. long, 4 mm. in diam., slightly glaucous, synanthous; scape robust, 2.3 dm. tall, 6 mm. in diam., wine-colored below, green above; spathe 3.8 cm. long, bifid to the middle, wine-tinted; umbel 2-flowered; pedicels 4.5 cm. long, green; perigone pale-rose, tepalsegs oblanceolate, 5 cm. long, 12 mm. broad; stamens and style as in the other species; ovary oblong, 6 mm. long.

Range.—Uruguay; Montevideo.

Notes.—Description based by Wright on Cantera #285, and on plants that flowered at Kew in July, 1899. According to Wright (1901), it is "Close to *Hippeastrum roseum* Baker [= *Amaryllis Barlowii* Traub and Moldenke], from which it differs in its terete leaves and 2-flowered umbel, and pale-rose flowers."

Amaryllis Hassleriana Chodat et Lendner, Bull. L'Herb. Boiss., Ser. II, 1:422. 1901; Traub & Moldenke, Tribe Amaryll. 137. 1949.

"[Description.—] Bulb rounded, about 2 cm. long, tunics brown, neck about 3 cm. long and 8 mm. thick; leaves contemporary with the flowers, linear, longer than the scape, narrowed toward the base which is 1.5 mm. broad; scape 8–10 cm. tall, filiform; spathe tubular for ⅔ of its length, deeply bifid at the apex, rose-colored, equaling or shorter than the pedicel and ovary to which it is joined; pedicel slender; tepaltube very short, obsolete; tepalsegs about 3.2–4 mm. long, stigma trifid.

"Related to *A. minima* (*A. parvula* Seub.) from which it differs in its broader leaves, its longer pedicels (1.2–2.2 cm. long), and three times larger perigone.

"Found in swampy places in the vicinity of Lake Ypacaray, December, [no.] 1711; flowers whitish, Paraguari, in pastures, January, [no.] 4726, Balansa."

Amaryllis caerulea Grisebach, Goett. Abh. wiss. ges. 24:320. 1879.

"[Descr.—] Belonging to [subg.] *Habranthus*, bulb extended into

THE PINK BELLADONNA LILY, *Amaryllis belladonna* Linn., var. *Haywardii.* From kodachrome by Miss Josephine deNancrede Henry.

Plate 8

an elongate vaginoid neck; scape precocious [= not contemporaneous with flowers?], about 2.2 dm. tall, umbel 1-flowered; the pedicel subequaling the bifid spathe; perigone 'pale blue,' 2.5 cm. long; the perigone-limb with slightly unequal divisions, simulating a slender-clavate tepal-tube beneath, dilated above the middle into elliptic-oblong mucornate tepalsegs; the three longer stamens subequaling the pistil, the three shorter slightly surpassing the throat of the perigone, stigma trifid. Compare with *H. pedunculosus* Herb. [Amaryll.] (pl. 26, fig. 3, shown as bluish in color), which is distinct in its 2-flowered umbel, and in having a perigone twice as long.

"Leaves not known; bulb 2.5 cm. in diam., neck 2.5–6.4 cm. long; spathe 2.5 cm. long; lower portion of perigone about 1.6 cm. long, the upper dilated portion 9 mm. long. Found in sandy places near Concepcion, Uruguay, blooming after the first rains in the beginning of March."

USDA DAYLILIES

Editorial Note.—Sixteen daylily clones have recently been distributed to nurserymen for propagation, and the U. S. Department of Agriculture does not have any stock on hand for further dissemination. Those interested may obtain them a little later when the nurserymen have had time to increase their stock sufficiently to offer them to the public.
These sixteen clones are named and briefly described below:

Mary Henry. Plant very vigorous and floriferous; 3½ feet tall; flowers of great delicacy, and sun-resistant, 4¾ to 5¼ inches across; petaline segments Barium Yellow (RHS 50–3), 1½ inches broad; sepaline segments Straw Yellow (RHS 60–4), 1 inch broad. Midseason. Fragrant. [Clone #31; see fig. 12.]

Stephen Foster. (See Figure 13.) Plant 3 feet tall; notable for entirely sun-resistant flowers of heavy substance, 4 inches or more across; orange throat; sepsegs ¾ inch, and petsegs 1 inch broad; segs iridescent, blood red (RHS 8–22) in the full sun, but in the shade the color is modified by the orange ground color, giving a deeper shade near Chianti. [Clone #152.]

Emily Dickinson. [Clone #76.] Plant very vigorous and floriferous; 3⅔ feet tall; notable for the delicacy of the sun-resistant flowers, 4¾ to 5 inches across; segs a glistening straw yellow (RHS 60–4) self; sepsegs 1 inch and petsegs 1¾ inches broad; very delightfully fragrant; early midseason.

Clarinda. Plant almost 3 feet tall; notable for long flowers, 5½ inches across; petsegs near Empire yellow (RHS 60–3) self, with narrow whitish stripe in center of segs; sepsegs 1 inch broad, same color, but nc stripe in center; moderately fragrant; midseason to late midseason. [Clone #79.]

Krishna. Plant vigorous, 4 feet tall; flowers to 4¾ inches across; petsegs 1¼ inches broad, velvety, near oxblood red (RHS oo8–23) over orange-yellow grouund color, and very narrow orange stripe through center of segs; sepsegs ⅞ inch broad, same color but stripe is only a faint line; very slightly fragrant; midseason to late midseason. [Clone #98.]

[To be continued in 1950 Herbertia]

REGISTRATION OF NEW AMARYLLID CLONES

Registrars: Prof. J. B. S. Norton and Mr. W. R. Ballard

This information is published to avoid duplication of names, and to provide a space for recording brief descriptions of new Amaryllid clones. Names should be as short a possible—one word is sufficient. It is suggested that in no case should more than two words be used. *The descriptions must be prepared in the form as shown in the entries below, and*

Fig. 12. *xHemerocallis* cl. MARY HENRY

must be typewritten and double-spaced. The descriptive terms used should be in harmony with those given in the "Descriptive Catalog of Hemerocallis Clones, 1892–1948" by Norton, Stuntz and Ballard.

There is close liaison between the AMERICAN PLANT LIFE SOCIETY and the HEMEROCALLIS SOCIETY regarding the registration of new *Hemerocallis* clones, and such new names can be sent to the registrars of either

society and will automatically be included in the records of both organizations. See also postscript note on page 134.

Correspondence regarding new amaryllid clones, including *Hemerocallis*, to appear in HERBERTIA should be addressed to Prof. J. B. S. Norton, 4922 40th Place, Hyattsville, Maryland, *enclosing self-addressed, stamped envelope, if reply is expected.*

For obvious reasons, there is a limit to the number of descriptions included from any one member in any one issue. Not more than five brief descriptions of clones under each generic heading will be published from any one member in any one issue of HERBERTIA. Descriptions of clones in excess of five brief descriptions, up to a total of 25, will be entered if the space required for each is limited to one line. In this case use should be made of the standard abbreviations already mentioned.

HYBRID AMARYLLIS CLONES

Introduced by Mrs. C. H. Armstrong, Joy, Illinois.

ALFRED. Leopoldii type A, 8½ inches across face of flower; pure white.

EVALENA. Leopoldii type A, 9½ inches across face of flower; deep velvety red; white throat; fragrant.

LILLIAN. Leopoldii type B, 7 inches across face of flower; pink.

JAYGEE. Leopoldii type B, 7 inches across face of flower; light red, with dark red markings in throat.

HYBRID DAYLILY (xHEMEROCALLIS) CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.;* (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.* (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.;* (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.;* (5) *Texas A. & M. College, Dept. of Horticulture, College Station, Texas;* (6) *Des Moines Park Board, Des Moines, Iowa;* (7) *Div. Ornamental Hort., Univ. of Calif., at Los Angeles.* [Complete addresses are given under *Officers and Committees, below.*]

Introducers should send complete collection of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

The following registrations have been made for members of THE AMERICAN PLANT LIFE SOCIETY. Names that have been published in the CATALOG OF HEMEROCALLIS CLONES (DCH) are listed by name only.

Introduced by E. A. Claar, Chicago, Ill.—The Doctor, EmRe; 36″; ORMl; de. (2705).

Introduced by C. W. Culpepper, Arlington, Va.—Abcada, M; 36″; LY. (2696); Darkten, EM; 42″; DR. (2697).

Introduced by R. F. Hawkins, Laporte City, Iowa. — In DCH, — Romeo, Vinore.

Introduced by Wyndham Hayward, Winter Park, Fla.—In DCH,—De Soto, Mephisto, Molten Fire, Montezuma, Rameses.

Introduced by H. M. Hill, Lafontaine, Kan. — Bright, MLa; 45″; R7M; ext. (2698); Apricot Dream, MLa; 45″; O7L; ext.; de. (2699); Cibola, M; 36″; O7L. (2700); Villanelle, M; 45″; R9L; ext.; de. (2701).

Introduced by Dr. E. J. Kraus, Corvallis, Ore.—Brownstone, MLa; 36″; ROD2. (2702); Evelyn Claar, EM; 30″; RL1. (2703).

Introduced by Mrs. T. J. Nesmith, Lowell, Mass.—Ivory Chalice, M; 40″; Y4L; de.; fr. (2704); In DCH,—Amber Lustre, Bonny Ruffles,

Fig. 13. *xHemerocallis* cl. Stephen Foster

Canyon Purple, Carved Ivory, Dancing Fire, Gay Heart, Guiding Light, Kentucky Cardinal, Lipstick, Pink Lotus, Pink Petticoats, Pink Prelude, Pimento, Pirate Treasure, Sorrento, Tallyho, Twilight Tryst, Wood Nymph.

Introduced by Mrs. A. R. Parry, Signal Mountain, Tenn.—Parry-Claar clones in DCH, — Chameleon, Jean Lafitte, Plum Mist, Royal Crown.

Parry-McDade clonies in DCH, — Cherokee, Chickamauga, Danny Boy, Hiawassee, Lovebird, Merryman, Nickajack, Sheila, Sonata, Spanish Cavalier, Whippoorwill.

Parry-Wood clone in DCH,—Neon.

Introduced by Sass Bros., Omaha, Nebr.—Evening Glory, EM; 40″; Y7L; de. (2706).

Introduced by S. E. Saxton, Saratoga Springs, N. Y. — Alnilam, EM; 20″; RDOYM3. (2707); Alnitah, EM; 20″; RMYM3. (2708); Arab Chief, M; 45″; YM2. (2748); Campfire, MLa; 30″; ORD1. (2709); Corduroy, M; 30″; RD2. (2710); Mintika, EM; 20″; RD2. (2711); Panda, MLa; 38″; RVDYM3. (2712).

Introduced by Mrs. Bright Taylor, Ocala, Fla.—Brocade, MRe; 42″; ROL2-H; ext.; ev. (2713); Brule'e, E; 36″; YOL2-S; ext.; ev. (2714); Citation, MRe; 36″; ORM2-H; ev. (2715); Cockade, MRe; 36″; OYL1; dbl.; ev. (2716); Constellation, MLa; 42″; OYL2-3; ext.; ev. (2717); Dark Victory, EMRe; 34″; VRD1; ext.; ev. (2718); Duna, EM; 34″; RM1; ev. (2719); Fern Irving, ERe; 48″; ARM1ext.; ev. (2720); Guinevere, MLa; 40″; ORM1; ev. (2721); H. Harold Hume, ERe; 36″; RD1; ext.; ev. (2722); Lodestar, EMRe; 42″; ROL2; ev. (2723); Nantahala, ERe; 36″; YOL2-H; ext.; ev. (2724); Penelope, MLaRe; 40″; RL1; ev. (2725); Pocahontas, ERe; 19″; RM1; semi-ev. (2726); Spice, MRe; 36″; ROD2; ev. (2727); Spring Dawn, EM; 42″; RL1; ev. (2728); Sugar Cane, MRe; 40″; OL1; ext.; ev. (2729); Sunset Sky, ERe; 32″; RM2; ev. (2730).

Introduced by R. M. Wheeler, Winter Park, Fla.—Albion, ERe; 38″; YL1; ev. (2731); Arla, EMRe; 40″; YL1; ev. (2732); Bacchus, EERe; 36″; VRM1; ev. (2733); Merceuse, EE; 36″; VRYL3. (2734); Brassy Sun, ERe; 38″; OYM1. (2735); Cameo, ERe; 40″; RL1. (2736); Diadem, E; 36″; ORLYM3; ev. (2737); Grey Pearl, M-La; 40″; VRL2-H. (2738); Lotus, EMRe; 60″; YL1; ev. (2739); Mirage, ERe; 36″; ROM2; ev. (2740); Niobe, ERe; 38″; VMR2-H; ev. (2741); Platinum Blonde, MRe; 50″; YL1. (2742); Sequin, ERe; 36″; YLR13-H-Rev.; ev. (2743); Show Girl, E-MRe; 40″; VR1. (2744); Tiara, EM; 44″; YOLROL3-R-Rev.; ev. (2745); Tomaka, M; 36″; VRD2-H. (2746); Tyrol, ERe; 36″; RMOYM3; ev. (2747); In DCH.—Ming Toy, Muscat, Olympus, Psyche, Raven, Vega.

CORRIGENDA:
DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1893-1948
(Publ. June 30, 1949)

It should be pointed out that the fundamental principle followed in the CATALOG OF HEMEROCALLIS CLONES (DCH), and one recognized in plant nomenclature everywhere, is that *the correct name of a plant is the first one printed with a description in a dated publication;* others for the same plant published later are synonyms (invalid). If a name already in use (homonym) is bestowed, the plant is without a name, and a new name must be chosen in place of the *later homonym.* A name registered with a registering organization is recognized by it, but of course is not binding on others, if there is a conflict with the fundamental rules.

The date to appear in the parentheses after names first published in the DCH, and also in 1948 HERBERTIA, vol. 15, is "1949." All dates following "Myb. 2" should be "1948."

[CORRIGENDA: DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, Continued on page 133.]

3. GENETICS AND BREEDING

HYBRID AMARYLLIS BREEDING IN SOUTH AUSTRALIA

E. Both, *South Australia*

After reading the many very interesting articles in Herbertia, I felt rather reluctant to attempt an article for the readers of this classic of all amaryllid publications, on our experiences with that super glorious

Fig. 14. Mr. E. Both, South Australia, hybridizing Gladiolus

flower of all flowers, the *Amaryllis Hybrids*. However, through the insistence of our mutual friend Mr. Fred Danks of Melbourne, Victoria, I have been forced to reconsider my previous resolutions, and so here it is:

If my memory serves me correctly, it was in 1928 that I first became

acquainted with the *Amaryllis Hybrids*. Well do I recollect being enthralled with the sheer beauty of my first 12 *Amaryllis* which were destined to eventually produce our present existing strain. There were two red and whites with the red predominating, and the other ten were a mixture of tricolors and bicolors, mostly a mixture of light to deeper tone reds with white and green midribs with various tonings in the throats. These were planted in 10″ pots under glass and became so engrossed with their sheer beauty that I quite overlooked the most important factor to cross-pollinate these the first season. Readers will, however, appreciate that I had ample time in between this flowering and the following season's flowering to set a schedule of various crosses, that, in my estimation could produce other colors, The time soon arrived, and in this instance there was no such miscalculation as in the past season as eventually there were approxiately 500 seedlings planted up in beds under glass, each cross correctly labelled and faithfully recorded. Two years later I had the pleasure of seeing the first results of my crossing with *Amaryllis*. In the majority of instances my calculations were sadly upset as I was yet to find out that the red was the predominating color. Even at the present stage, although the various colors may now be inbred for at least 6 to 7 generations, unless one is mighty careful, the red will persist in popping up when least expected.

However, it was not until in the third year that the slightly weaker plants flowered, and in amongst these found the decided breaks in color that I had previously anticipated when crossing. Two were very outstanding breaks in color, No. 3 and No. 4, pink. No. 3 pink showed a blending of salmon, orange, and a touch of rose. No. 4, pink had a similar mixture with rose predominating. Other crosses again produced deeper toned reds, the heavy white midrib was gradually receding, and a deeper tone was also developing in the centers. At this stage I had better mention the basic principle on which I work to increase or decrease the intensity of color, size, and improvement of shape.

These do not vary to any marked degree over and above that which is recognized by other hybridizers of flowers or as far as that goes breeders of blood stock. Just in case any readers are not conversant with these principles they are as follows:

To intensify color. You take the pollen from the deeper toned color and cross it onto the stigma of a lighter toned color.

To lighten or decrease the depth of color. The pollen of the lighter tone is crossed onto the stigma of the deeper tone—actually the above cross in reverse.

Selfing Colors. If a flower ¾ red and ¼ white were crossed onto a flower which only had ½ red and ½ white, the corresponding offspring would show a bigger percentage of red and a corresponding decrease in white. After several such crossings a self would eventuate.

To increase the size of any one bloom, or any individual tepalseg, you select the pollen from one with larger tepalseg and cross it onto a slightly smaller bloom. If the two blooms are approximately the same size we would strongly advise any potential hybridist to cross these both ways, because in the latter instances marked increase in size is often found in these crosses.

In crossing for shape immediate results on improvements of all tepalsegs cannot be expected. It is certainly far better to cross for the improvement of each set of tepalsegs, that is to say, the two top inner, the two bottom outer or inner bottom or top outer tepalseg each at a time. Although it may be possible to increase the size of the two inner top tepalsegs and decrease the size of the bottom inner tepalseg in one cross, it is far better to select blooms with a view of just increasing the size of the two top inner tepalsegs. Once this has been achieved it would be quite an easy matter to select seedlings from this cross where the desired improvement showed on these tepalsegs and then to cross the pollen from those having the slightly smaller inner bottom tepalseg onto the slightly

Fig. 15. The Both Family and Friend,—From left, Helen Both, Ann Both, Mrs. Lange, a great friend of the Boths, Bob Both, Marlene Both, Mrs. E. Both, and Elizabeth Both.

larger one with a view of decreasing the length of this tepalseg and retaining the increase in size elsewhere.

Another very important factor that one must not overlook is to make a close study of the grandparents as well as the great grandparents before one can be reasonably assured of what to expect in the offsprings.

Working on these theories, and bearing well in mind that red was the predominant color, every bit of my knowledge on cross-pollination was used to further break up the then existing colors and endeavor to merge the colors that had appeared in the markings with a view of creating new colors.

The two pinks previously mentioned played an important part in eventually producing many very beautiful and rare colors. This was achieved in crossing No. 3 and No. 4 pink both ways, back to their par-

ents and also on to seedlings that showed a slight variation either on the edges of the tepalsegs or deep in the throat. Other seedlings where the midrib had receded these were crossed with a view of selfing that particular color. Where a slight variation occurred in the throat marking or the midrib showed a variation of color these were crossed with a view of extending the color out of the throat and to extend onto the tepalsegs. Quite a number of named varieties of gladioli in cream and yellow are green in the bud stage. Although experts frown upon green in an *Amaryllis* hybrid. I set about to self a green with the hopes of eventually producing a cream or the much desired and elusive yellow. Our second lot of crossings mostly followed this routine quite naturally and all were faithfully recorded and every seed planted in such a manner that in our estimation would hasten results. Two years later I had the pleasure of seeing further improvements—many hopes dashed to the ground but quite a few that were very promising. Amongst these No. 251 was undoubtedly the most outstanding—the color on the outer edges of the tepalsegs was a rosy carmine and the center a pure white. This particular variety was the start of our rose shades and also played an important part in our marginata—varieties with a white center and edges of tepalsegs of various colors. In others a rosy lavender, a deep rose red and whites with but slight markings appeared. The latter after several crossings eventually produced our first white. The rose reds were then crossed with various seedlings where a slight blue edge had appeared on each tepalseg and also onto ones where a blue toning appeared in the depth of the throat. After 3 or 4 crosses we were fortunate in securing our first cerise and later petunia and purple appeared. In our last batch of seedlings traced back to these crosses we had the pleasure of flowering one of the most beautiful *Amaryllis* hybrids. This particular flower was all but a "Vieaux Rose" self, the only markings being a margin of white on the tips of each tepalseg. Another seedling out of the same cross was a pure magenta with a pure green throat very definitely marked. A very beautiful seedling and one which I value to a very marked degree for breeding purposes. The No. 3 and 4 crosses gave us some very outstanding pinks and these in turn in later generations gave us our copper reds, rose, buff, salmon, orange. As soon as the buffs appeared we immediately crossed these into a green with a brown throat marking and were very pleased with the results in securing our first deep cream with a brown blotch. Later we crossed our white self into this cream and produced some very beautiful creamy whites with very delicate brown tigrening. These in turn are now being used to intensify the brown tigrening with a view of producing either a brown self or who knows that elusive golden yellow. The receding white midrib crossings onto the increased midrib were now reaching a stage where the red self was not far distant. When these eventually did appear the pink self soon followed. The deeper throat markings similarly handled deepened our very dark reds from wine, dark blood red, maroon to almost a deep black red equal in depth of color to that wonderful old time Gladiolus "Moorish King."

Another outstanding seedling is number 127. The variation in color of the various seedlings from this particular numbered seedling is re-

markable. Smoky colored gladioli have without a doubt been my weakness and I have often visualized that in some future date it would be possible to produce a similar coloring in *Amaryllis* hybrids. One of 127's

Fig. 16. *xAmaryllis* cl. Both #11,086

seedlings has given me great hopes that this should materialize at not too far distant a date.

Markings, margins and delicate tigrening on a pure white background have also interested us immensely. The pure white center with a red edge or margin on the edges of the tepalseg are beyond description and I hope in the not very far distant future to produce these with

frilled edges. Although during the past season we handled practically all colors we have as yet to produce the blue and yellow. Whether this is possible is problematical. I feel confident that the golden yellow self is just a matter of time [*Amaryllis aglaiae* is butter yellow.—Editor], but the actual problem is the blue—to self those with slight bluish markings in the throat and also upon the edges of the tepalsegs, with the red color predominant, is an extremely doubtful procedure.

In the production of the double *Amaryllis* hybrids we have not been so fortunate as we were not lucky enough to fluke that eluding freak double pollen imperative for evolving that elusive yet beautiful double *Amaryllis*. The pollen to which I refer does not come from the center of the flower but is attached to one of the tepalsegs. Strange as it may seem, three seasons ago the freak pollen bearers appeared amongst our gladioli and also in our *Amaryllis* hybrids. So far we have not been fortunate enough to see the results of the *Amaryllis* crosses but in the gladioli we secured quite a number of semi-double glads still producing the freak double pollen bearers. Now that the double *Amaryllis* is within our reach we are paying special attention to those numbered seedlings with slightly frilled and intense crimped edges. The twisted and twirled tepalsegs as well as the orchid shaped are all doing overtime because a double without frill or fringe, twisted or twirled tepalsegs would be sadly lacking if without these essential features.

Have often admired the beautiful reproductions produced in Herbertia each year. The tendency for the two top inner tepalsegs to be the smaller and the outer tepalsegs larger appears to be the most desired. I quite appreciate that the following remarks are likely to be criticized by a number of leading experts. Although in direct contravention to the opinion of others that which appeals to me most as the perfect shape would be the flower with 6 equal sized tepalsegs. The width would be such that they overlap considerably and only on the very tips would there be any break in a perfect circular outline. A really beautiful shape is the flower where the two bottom outer tepalsegs are slightly smaller, the two top inner tepalsegs slightly larger, the top outer tepalseg extending over the full width of the flower and the bottom inner tepalseg in proportion to the two bottom lower tepalsegs—shape similar to a shell with crimped edges. Even though this shape is extremely beautiful, the 6 equal sized tepalsegs are without a doubt the desired shape. Shape has played an important factor in our crossings during the past 6 to 7 years, but in reality these crossings have been infinitesimal in comparison with the number of crosses made solely and purely for the creation of newer colors.

As a slight indication we handled anything from ten to twenty thousand seedlings prior to the war each year, and for the duration of the war, this was but slightly reduced.

Size undoubtedly plays a big part in the winning of grand champions at Australia's leading Gladioli Classics. We have naturally been thrilled with the success of rank amateurs winning with our Gladioli releases each year and producing spikes on the showbench equal and at times even bigger and better than the results we achieved in our testing plots.

In one instance Tunia's Wizard—our 1947 release—was staged with the bottom floret a fraction over 11″ across. With the *Amaryllis* hybrids we have endeavored to improve color and shape. The sizes of our blooms are not considerable as most vary from 8″ to 10″ across, although one or two badly shaped 12″ florets have appeared.

Sports are apparently quite prevalent amongst gladioli but for us as

Fig. 17. *xAmaryllis* cl. Both #333, pure white.

regards color have as yet to appear amongst our *Amaryllis* hybrids. One very interesting feature did occur with us approximately 2 years ago: one bulb developed with 2 side shoots, the original plant had a self green leaf on one side and a variegated set of leaves on the other side. The small side shoot on the green side was also green, on the other side the side shoot was the same as the variegated leaves. This season we intend cutting this bulb in halves and will endeavor to propagate the variegated section.

Propagation. We would like to take this opportunity in CONGRATULATING AND OFFERING OUR SINCERE THANKS to the various growers who were good enough to elaborate on their very interesting experiences in the propagation of named varieties of *Amaryllis* hybrids. Strange as it may seem, although our experiences were rather crude in comparison they were remarkably similar. A thin square prong digging fork was used in the lifting of some of our selected numbered seedlings and through a mishap the fork cut one of these in halves. Being a variety of great value for breeding purposes, I planted the two halves, trusting that life would still exist in one of the halves. I was greatly surprised to notice that two small bulbs formed on each half and later developed into four full sized bulbs. To me this was a revelation and quite naturally I set about trying various methods with a view of quickly propagating any selected seedling. A pure white was used in our first experiment. This was cut perpendicularly from top to bottom into 8 equal pieces, but through an excess of moisture we lost the lot. Another bulb that I used in my second experiment was an outstanding fiery scarlet self, No. 43. This particular bulb was cut up the same way as the white one but under dryer conditions, and eventually produced just on 50 small bulbs. I tried out quite a number of methods, but the one that appears to be the safest and at the same time, gives the most satisfactory results, is to select a bulb with only the root growth in the ground. The top ½ portion of the bulb is cut off, or in other words, the bulb is cut horizontally in halves. The top section is naturally discarded as useless, but the bottom half is then cut perpendicularly into approximately 20 pieces. Do not cut right through the basal plate and endeavor not to disturb the old root growth. As the small bulbs develop and show signs of developing a small root growth of their own, these bulblets are cut off with a very sharp knife, the wound is allowed to heal in the shade, and is then planted in a propagating frame. Several weeks later found a further batch of bulbs forming, and they in turn were treated the same way as their predecessors. After taking off four such crops the last fourteen were allowed to develop on the plant and in 12 months were 1½″ across. The small bulbs were transplanted, flowered two years later. We however, found it necessary to do this in the beginning of September (spring) just prior to the time when our bulbs come out of their dormant stage and start into their new season's growth.

Growing Conditions. Perhaps at this juncture it may be of some interest, to the readers of this article, to read about the exact treatment we give our entire crop. We will start just prior to the dormant stage. During June, we find it necessary to send our plants under glass dormant, the leaves are cut back, to within 6″ of the neck of the bulb and when the sap recedes this is then cut back again hard into the neck of the bulb. The soil is slightly moist and is cultivated. Two weeks later we dust the whole planting with lime mixed with black leaf 40 known in Australia as Nico Dust. The idea of the black leaf 40 is to kill any mealey bug or aphis that may have attacked the plant and the lime to kill any slugs or snails that may have found their way into the glasshouses.

Towards the end of July the lime is cultivated into the ground and

a slight watering given. As soon as possible the ground is again cultivated and the plants allowed to stand until they show signs of again coming into active growth. A dressing of dried blood meal is then given at the rate of 160 lbs. to each 5,000 plants. The area can be easily calculated as our plants are grown in rows 6″ apart and 6″ in between each plant in the rows, thus giving each plant 6″ square to develop. Before watering in we consider it imperative to cultivate the dusting of blood meal into the top soil so that each plant has a reasonable chance of receiving the same amount of benefit. Watering at this stage is on the heavy side and it is naturally increased during the flowering period. When the seed has been harvested the flower stems are all cut off, and the

Fig. 18. *xAmaryllis* cl. Both #6, orange red self, deeper throat, 10½-inch diameter.

ground again hoed. During December we again give a slight blood meal dressing approximately half the quantity of the previous one. The plants are watered on an average of once a fortnight and are thus kept going right up to the next season's dormant stage. We are great believers in this December blood meal dressing,—the leaves appear to grow out of all proportions, and at times are up to 4′–6″ long, and in cases 4″ and even wider. It is remarkable just how these 4′—6″ leafed plants produce the tall flower stems the following season. Our tallest measuring 4′–3″ from ground level to the top of flower head.

To date we have not finalized on any definite method of commer-

cially propagating in any outstanding seedling with a view of eventually naming these and placing them on the market. All our stock offered for sale are grown from seed. We were rather surprised to notice the poor germination reported by some growers after a period of approximately 3 months after harvesting. Should we have a surplus of special crosses at the end of any season these are kept until the beginning of the next season and planted with the next season's crop. Two years ago we had rather a heavy carry over and took particular notice just how the previous season's seed germinated. In quite a number of instances there was a better germination than from the fresh seed, although we must admit that the germination was poor in the very delicate pink crosses. When harvesting our crops of seed we earmark any valuable crosses. As soon as sufficiently dry these are planted singularly in thumb pots (1½″ diam.); approximately 3 months later they are then transplanted into 2½″ pots where they remain until they become rootbound, when they are again transferred to a 4″ pot and allowed to develop into approximately an 1¼″ bulb. Specially prepared beds are then awaiting these bulbs. Approximately 15 months later the first then begin to flower but are at their best the following season. Our reason for going to this extra amount of trouble is that if the very small plants are planted direct into the beds quite a number of the weaker plants do not bloom, whereas in this instance very few do not flower before the 3rd or 4th year when the picked seedlings are transplanted into fresh beds and the remainder commercialized. In preparing a bed for planting we remove approximately 18″ of soil, in each 6′ there is a bore sunk down to the marl and filled with cinders. The cinders also cover the bottom 6″ of the bed. On top of this we put 12″ of specially prepared soil. This is composed of equal parts of leaf mould, garden loam, Mount Gambier Volcanic Soil, which in appearance is very similar to black peat, and one part of either shell-grit or lime mortar and sand. The component parts are thoroughly mixed before being transferred to the glasshouse. The seed of the ordinary selected crosses are planted up in beds with the seeds just touching in the rows and the rows 1″ apart. Approximately 3 months later these are transferred out in the open into beds 180′ long by 14′–6″ wide. These are in reality glasshouses with sides only and when the plants are 2 years old are covered with a glass roof, so that the plants are protected when they come into bloom.

As each crop is lifted out of these glasshouses the glass roof is transferred to the adjoining plots, which are also with the exact same size with posts also identically spaced. We also have six 50-ft. glasshouses where the extra selected crosses are tested. These are under glass continually. All the extra selected marked seedlings eventually find their way to our display house. This glasshouse is approximately 106′ long by 25′ wide. The roof is a huge leanto and the beds inside are raised in such a manner that they follow the slant of the roof. Perhaps more explicitly explained when I use the terms we so often hear, that when the bulbs are dormant, it resembles a stadium. Only the very best and most outstanding colors, shapes and sizes find their way into this glasshouse. and it is from these that we make our selected and extra selected crosses.

Quite a number of times when we find an improvement in our other

glasshouses amongst the seedling patches we pick these flowers and place them in bottles so that the stem is approximately ½" away from the water level. Whatever space there may be between the stem and the neck of the bottle, we pack with dry wadding. These flowers apparently develop normally, and in most instances will even set seed if pollinated, and the pollen is then naturally used with a view of further improving that particular color. Should slugs or snails find their way into this house and damage any stems, they are also picked and transferred to bottles until the seed is harvested.

In Australia there is no recognized *Amaryllis* society but we do claim that in South Australia, even without a society, we have a wonderful bunch of *Amaryllis* hybrid enthusiasts and admirers. Many hundreds and perhaps I would not be exaggerating in saying that many thousands call each year to admire the blooms in our display glasshouse.

There are many hundreds of enthusiasts who grow the *Amaryllis* hybrids, both under glass and also in the open in South Australia. But I would feel somewhat amiss if I did not at least mention about 10 who have gone past the stage of being enthusiasts, and are in reality *Amaryllis* hybrids fiends. Heading this list would undoubtedly be Bruce Hudd, the man who has made so many criminals squirm with his uncanny knack of being able to trace fingerprints. He is the fingerprints expert in our State's C.I.B. and is undoubtedly an outstanding specialist in this particular department. Huddy's experiences on *Amaryllis* hybrids goes back many years and he has often related just how these were grown 30 years ago. He was rather surprised to see us blooming our extra selected seedlings in 18 months, and often moans the time he wasted trying to get flowering results in 4 to 5 years. He has taken a very keen interest in each new color that has appeared. He is a strong believer in a perfect evenly balanced round flower and often looks with contempt at some of the seedlings which were specially crossed to produce twirled narrow tepalsegs. I had gone to some considerable trouble to produce a flower similar to the red *Sprekelia* in the various shades, and as each of these eventuated it would be amusing to see the look of disgust on his face as he viewed the so-called mongrels and yet those eyes would sparkle with pride as he would view any improvement in a perfect circular bloom.

Charlie Gilbert, also one of the old brigade, and still a great lover and grower of our beautiful flower, grew considerable quantities in practically pure sand and it was remarkable the wonderful results he achieved under these poor conditions. Charlie is also still one of our annual visitors. Bob Paterson finds a great pleasure in his retired life in growing Cyclamen during the winter and to finish up his display in his beautiful glass house with *Amaryllis* hybrids. Strange as it may seem, the same two flowers are grown and admired by Hugh Price, Reg. Leahy, Alb. Lindsey, Len Bevan and Vic Stephens. Whereas with Tom Jolly and Perce Sampson they believe in intermingling their *Amaryllis* hybrids with Delphinium. The writer, whilst also being a great admirer of Delphinium, has a very great sneaking regard for Cyclamen. I feel quite confident in making a claim that although we have no society, no better feeling could exist than that amongst this wonderful group of *Amaryllis* hybrid enthusiasts in South Australia.

In conclusion I would like to take this opportunity in offering my best "Amaryllis Hybridia" Greetings to all lovers of this king of all flowers, and do sincerely trust that their 1949-50 display will be their best yet.

To fellow hybridists may your success be treblefold, and may that evasive yellow and blue *Amaryllis* hybrid be a reality in the near future.

Box 1091-J, G. P. O.,
Adelaide, South Australia

HEMEROCALLIS BREEDING—THE HURST BAND SYSTEM

GRAFTON W. SHULTS, *Maryland*

Detailed by Lewis A. Hurst in HERBERTIA 1947 is the answer to the backyard Daylily Hybridizer's prayer.

How would you like to grow, in a plot 6′ x 60′, 8,400 seedlings instead of 1,440? You say—"It can't be done!"

That's what *I* thought. Even when I saw the plan in operation last summer with thousands of lilies blooming in one-third of an acre in their original seed-bed and no weeds because the twelve inch centers from band to band shaded them out; I still said—"I don't believe it!"

The idea fascinated me and I went back later in the season just to see the plants, because the peak bloom was past.

Then this fall (1948) when I plotted the bands on paper and estimated my potential yield, I again said "No, it can't be,—let me read that thing again!" It's too simple, and that's why you just can't accept it until you work it out as I did.

In the spring of 1948 I rented a garage on a nearby lot 100′ x 150′ with permission to fence and garden. I planned a series of 6′ x 60′ raised beds with 12″ walkways lengthwise through the center. I had sufficient seedlings from the conventional seed box to set 1,440 plants on 5″ centers. I thought I had something—1,440 selected crosses from eight different HEM-BUGS!

This fall (1948) I used another of the 6′ x 60′ spaces, dividing into 8 individual 6′ squares with a 20″ walkway separating each (all soil having been removed from the 20″ x 6′ walkway, and stone-and-ash-fill substituted).

Each of the eight 6′ x 6′ plots accommodates six 2″ x 6′ Hurst Bands on 12″ centers. Each Hurst Band accepts one level (chef's) tablespoonful, or approximately 175 seeds.

Therefore 8 plots x 6 Hurst Bands x 175 seeds per band = 5,250 potential seedlings, representing thirteen hybridizers—all in the same sized area which produced 1,440 on 5″ centers the previous season.

Remember, you will enjoy earlier blooms, too, induced by the simulated pot-bound root condition assisted, of course, with good old 5-10-5.

All the above, plus no transplanting (except the "Selects" as they bloom)—and a minimum of weeding is your gift from Lewis and America Hurst. A delightful contribution to the HEMEROCALLIS devotee.

4. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

DAYLILIES IN AUSTRALIA

FRED M. DANKS, *Corresponding Fellow,*
Victoria, Australia

It may seem strange that after some years of experience with daylilies in Australia there is little to tell of results, but until a comparison with named clones can be made, the seedlings we have cannot be rated at all. Good friends have recently provided the named American clones for comparison but minor mistakes in handling have delayed satisfactory flowers so far.

The first lot received were put in pots so that they could be handled with care and sheltered from undue heat. A few bloomed poorly, and then in the transfer to permanent positions—delayed a little through pressure of other tasks—a further set-back was experienced. A second batch was put right into the permanent position in beds, but they arrived a little late so it is a matter of awaiting this year's (1949-1950) flowers to see them at their best.

This does raise the question as to the best time to ship plants, but the ease with which they survived a protracted journey when sent in the fall season is a factor we cannot lightly pass over. It seems that any sizable piece (ramet) will stand three months out of the ground and still have the life within to start again even in strange surroundings to meet severe heat so soon. Small ramets, under the conditions of the experiments, will give leaf growth but they fail to make any roots and eventually die. Such small ramets could apparently be sent by air mail and grow satisfactorily. Surface mails suffer delays that seem hard to account for since the three weeks of ocean travel is the main part of the journey but to date there is usually a three months' period before delivery with quarantine and other inspections added.

Among an expanding collection of seedlings, there are many that attract, but from day to day these may vary somewhat in color and shape due to the climate. We get extremes with high temperature alternating with cold "snaps." They undoubtedly have a place in our garden displays for they survive long dry times and flower freely with a minimum of care.

At this writing (August, 1949) it can be said that soon now flowers will show and later reports will tell of the successes. It will also give the opportunity for us to compare our seedlings with American named clones. At present commercial possibilities are limited for gardeners look upon *Hemerocallis* with doubts, and are not educated to distinguish between hybrids and the older types. In due time this discernment may come. I will see to it that the more important nurserymen get propagation stock as soon as possible.

I have always sown seeds in the spring fearing the loss of the types

that died down in winter if sown in autumn. However, it is possible to put them in immediately on gathering and some could be hurried along to give flowers the first spring.

It will be many a day before we have all of the named clones that you enjoy, and a long time before the public is educated to demand them. We have so much to enjoy and can grow most flowers so that competition is keen and fashion often rigid. Perhaps *Hemerocallis* will eventually make a place for themselves in Australian gardens.

DISTANT SHIPPING OF DAYLILIES

GEORGE GILMER, *Virginia*

In August 1947 and August 1948 I shipped daylilies to Mr. Fred M. Danks in Australia. There were twelve roots in one shipment and twenty in another. They were shipped by ordinary parcel post. There were between two and three months from date of shipment to date of arrival. All of the plants survived shipment across the Equator.

The plants were carefully dug, thoroughly washed, and dried in the sun until there was no appearance of moisture on the outside of the roots. The tops were cut back to one or two inches of the point where the roots came out. One year the short roots were cut back to two or three inches. The other year they were left normal length. No difference was reported. Each individual root was wrapped in paper. They were then tightly wrapped with no provision for ventilation.

I selected August for shipment because the plants were fairly mature at that time and they should arrive early enough in Australia to have a fair growing season.

I prefer to ship and receive plants packed damp if the distance is short, but if the weather is hot and humid I have had some losses from damp shipments where they were only going part of the way across the United States. If they are packed for a long or hot trip, unless they are dry, they have a tendency to rot and become soft.

NEW DAYLILIES

PHILIP G. CORLISS, *M.D., Somerton, Arizona*

None but Superman himself could "snatch a peek" in one season of all the new Daylilies our hybridizers are producing for our future garden pleasure. I was fortunate during the summer of 1948 to visit some of our prominent growers in the northern tier, and I hope my report will be of interest to you.

First I visited the Milliken Gardens in Arcadia, California. The famous Iris exhibition garden is directly across Highway #66 (where you get your kicks) from the Santa Anita race track. Mr. Milliken took us, however, to the larger field where his *Hemerocallis* were blooming. Here was his 1948 introduction, GARNET ROBE, which I have elsewhere described as the best new daylily I saw in 1948. Mr. Milliken says in his catalog, "We do not have nor have we seen, any other *Hemerocallis* in the dark tones to challenge it"—and that is a masterpiece of understate-

ment! There are brighter reds, and darker ones, but none like GARNET ROBE!

Two other fine reds were offered by Mr. Milliken this year. Both were more brick red. POMPEIAN RED is 2½ feet tall, has a light throat, and is more on the orange side than RED ROCK CANYON, which is four feet tall, also with a light throat. TAMARA and PARTY GOWN are fine bicolors. The dark color in the petal of PARTY GOWN does not extend far towards the throat. COLONIAL DAME and RUFFLED PINAFORE are excellent apricots. CATHEDRAL TOWERS has a very large brown eye marking on the petals. All of Mr. Milliken's flowers have medium-large to large flowers of heavy substance. Two months later I visited the Milliken Gardens again and saw some fine seedlings. Mr. Milliken was quite noncommittal about them, so I feel he has some even finer ones under cover and coming up.

I felt particularly fortunate in being able to visit with Dr. Stout both at the New York Botanical Gardens and at his suburban home with his charming wife. Dr. Stout is reticent about his unnamed seedlings, but he kindly showed me one of his new doubles. He says there is no Kwanso blood in these doubles. Alas, he told me it will be perhaps ten years before he will be satisfied with these doubles and designate some for introduction. I think most *Hemerocallis* fans understand the arrangement by which all of the Stout hybrids are introduced by the Farr Nursery at never more than three dollars. This arrangement necessitates delay while a large stock is grown. Every daylily that Dr. Stout introduces has been thoroughly tested, and is the best of its type. I recommend a visit to the Farr Nursery for a view of Dr. Stout's wonderful new daylilies. In deference to his wishes, I am not even going to tell you about some of the new things that are almost ready for release. But they are there, and they will be ready for our gardens one of these days, and when they are, remember that I told you!

During June and July I was able to visit the Fairmount Gardens nearly every day for five weeks. I saw all of Mrs. Nesmith's 1948 introductions except the three late ones—EBONY BOY (dwarf red-purple), FAIRY LUSTRE (yellow) and MME. RECAMIER (pink). My favorite was WINDSOR TAN, a bicolor of tan and buff. The flowers are large and full, about the size of BOLD COURTIER, but not so tall. BALTIMORE BELLE and PYGMALION are fine pastels. BURNT ORANGE and GAY ROMNNY are brilliant and striking, and THUNDERHEAD is the new dark one.

Two of the most striking flowers in the garden were seedlings of Geddes Douglas, which Mrs. Nesmith will introduce this year or next. One is a very large true red with a green throat. The size and intensity of the color make it outstanding. The other is a large pink. It is much larger than ROSALIND, and heavier in substance, and has been named PINK RADIANCE. I was able to study and photograph the following 1948 introductions of Mrs. Nesmith:

PINK PETTICOATS has a medium-large flower of rosy pink. The petals and sepals are extremely recurved and both are creped. There are prominent darker veins in the petals, and a heavy cream midrib. The small throat is the same shade as the midrib, with a green center.

Gay Heart is a large (6½″) star-shaped pink flower with flaring and somewhat recurved petals and sepals. The petals are crinkled and have a bright yellow midrib. The sepals have a yellow center stripe running into a throat of the same color. The flower is over four feet tall.

Amber Lustre is an outstanding new flower in the apricot shade. The sepals are recurved. The petals are very wide and have a creped cream border and midrib. The flower is unusually large and flaring. It has a darker halo. The cinnamon overlay looks as though it had been painted on in narrow stripes, and the center is a brilliant gold. Four feet tall.

Canyon Purple is larger than most of the purple flowers (6″). It is a full and open flower with a green throat. The tips of the sepals have a slight twist, and both sepals and petals are slightly fluted.

Twilight Tryst is a fine new member of the evening bloomer class. It is light yellow with a dark narrow halo on the petals. The flower has heavy substance, is tall, large, well-branched, and slightly ruffled.

Bonny Ruffles is another evening bloomer. It is a yellow self, with very ruffled petals and sepals.

Pink Prelude marks what Mrs. Nesmith believes is her greatest advance toward the true pink. It is a self except for a lighter midrib on the petals. The flower is not very tall (two and a half feet) but is remarkably beautiful, with a fullness that is not coarse, and a delicate creping.

Other fine Nesmith introductions for 1949 are: Tallyho (vermilion), Dancing Fire (red, with yellow cup), Sorrento (large wine red), Wood Nymph (dark wine, green throat, lily shape), Kentucky Cardinal (rich red, yellow touches), Guiding Light (nice yellow), Pink Lotus (large coral-pink, star-shaped), Carved Ivory (extremely light self) and Pirate Treasure (recurving orange with darker veins). Doesn't Mrs. Nesmith get the most wonderful names? Mrs. Nesmith is particularly interested in the melon shades, and has many fine seedlings which she is watching. When they are introduced, they will have to meet her rigid requirements for growth and branching.

The new creations of our other hybridists I have not yet seen. I have been in correspondence with Prof. Saxton, Wyndham Hayward, Dr. Traub, Mr. R. W. Wheeler and Mrs. Bright Taylor. I have seen pictures of the 1949 Saxton and Wheeler introductions, and several of them are thriving in my own Arizona garden now. What else they, and the many other fine hybridizers whom I do not yet know, have in store for us, I cannot say, but I am certain they have many fine new things. Aren't we lucky?

EUSTEPHIEAE AND EUCHARDIDEAE

LEN WOELFLE, *Ohio*

Almost everyone, young or old, rich or poor, is familiar to some degree with the *Narcissus:* The never-failing showiness of the Paper White during the long drab winter months when our gardens are particularly lacking in blossoms; the fragrant Jonquil, a perennial standby; the classic beauty of the Trumpet Daffodils, glowing golden "King Alfred," the madonna-like pure whiteness of "Beersheeba," and the striking apricot-pink of "Mrs. Backhouse." All these add more than a little to the satisfaction we obtain from our gardens.

But how many of us know the stately splendor of *Ismene calathina,* the tall, graceful *Elisena,* the beautiful foliage and many flowered umbels of the deliciously scented *Hymenocallis?* How many of us are aware that a group of relatives of the *Narcissus,* containing approximately a dozen genera and in the neighborhood of a hundred species, almost encircle the globe in a belt some three thousand miles wide, matching in stateliness the finest lilies and containing all the hues of the rainbow? All are preeminently beautiful and almost all of such simple needs that any of us can grow them successfully, if only we know their simple requirements and supply them.

The genus *Pancratium,* from the Mediterranean and the Canary Islands, give us three species, *canariense* and *maritimum,* which are pure white, and *illyricum,* which has a creamy or yellowish cast. These may be grown in pots, or in the garden, where they bloom during the summer. The long, glaucous foliage of *maritimum,* however, is persistent, and this species is best if kept in slow growth in pots over winter in a light, cool basement or greenhouse. It may also be dried off and stored in sand, soil or other material like the other species, but is perhaps the better for being kept in growth.

The genus *Hymenocallis* has a much greater range than *Pancratium* and is found in Senegambia in Africa, the islands of the Caribbean, Northeastern South America, Florida and the Carolinas, Texas and Mexico.

Hymenocallis Harrisiana has two or three dainty pure white blossoms on a round scape about twelve inches high. It does well in the garden or may be grown in pots. It should have complete rest in winter and may be stored dry if kept warm, in a temperature 55 to 70 degrees. It comes from Mexico and is supposedly hardy to Philadelphia.

Hymenocallis occidentalis, a native species, is deciduous, and nearly hardy like *Harrisiana.* It has many small-cupped pure white blooms in summer. This is best if potted over winter, watered only sparingly to preserve the root system.

Hymenocallis macrostephana, "large crowned *Hymenocallis,*" is a supposed cross of *H. speciosa* and *Ismene calathina.* It is evergreen and bears up to ten large white cupped blooms, 2″ wide and about as deep. It is perhaps best grown in pots, but the writer has stored one bulb of this completely dry in peat moss the past winter, without any apparent damage to the bulb.

Hymenocallis rotata is another native species, suitable for garden growing. Five to eight blooms in summer. This may be stored dry in sand, soil or peat over winter, but better if potted in fall. It may also be grown in pots.

Hymenocallis senegambica has only been grown by the writer in pots, but indications are that it may be grown in the garden, as its behavior in pots is not unlike Rotata. It has long, very narrow, dark green foliage and six to eight pure white blooms in late summer. I think this one is exceptionally good. It is the only species from Africa.

Fig. 19. Left, *Hymenocallis rotata,* and right, *Hymenocallis tenuiflora.* Photos by Len Woelfle.

Hymenocallis speciosa is a large plant, with somewhat oval leaves and up to twenty very fragrant blooms, pure white, with a cup about 1½″ wide and as deep. This is evergreen and blooms in late winter in pots. It is from the West Indies and is considered the most showy in bloom.

Hymenocallis tenuiflora from South America is very similar to Rotata in growth and habits. Treat as *rotata.*

The writer also has three unidentified species or varieties of these plants, one similar to *speciosa,* one similar to *rotata* and the other entirely different from any he has ever seen. I hope with future experience to place these.

xHymenocallis cl. *Daphne.* I have not yet had the pleasure of blooming this one. It is a hybrid of *Ismene calathina* and *Hymenocallis speciosa* originated by Van Tubergen of Holland in attempting to duplicate *H. macrostephana.* It is a beautiful evergreen plant, with foliage more like *Ismene calathina,* and according to the originators carries many large, pure white blooms. It should be kept on the dry side during winter to promote spring flowering.

The genus *Ismene* is native to Peru and consists of about four species known to date. All bloom in spring if planted in the garden toward the end of May. All are very stately plants and require identical treatment. For best results they should be dug the early part of October or after the first light frosts and stored warm and dry over winter, 55 to 70 degrees. They may also be grown in pots, started into growth about March and are said to bloom in May. I have never tried this, and I think I should prefer to grow them in the garden, giving them treatment as above. In any event since they grow so vigorously I believe they would be better if planted out of pots into the garden in May or June to renew their bulbs.

Ismene Amancaes, the sacred Amancaes of the Peruvians, has deep golden yellow flowers in June. This is very rare in cultivation, but available. It is one of the parents of the hybrid Sulphur Queen. It has narrow yellowish foliage.

Ismene calathina (see Fig. 208 in 1948 HERBERTIA), the giant Peruvian Daffodil, has beautiful white cups about three inches long and almost as wide, the pure white lobes fringed or torn like shredded tissue. Green keels and bears from two to five blooms soon after planting in the garden. It is very easy to grow and bloom and a good multiplier. The other parent of the hybrid Sulphur Queen. It has large rich green foliage.

Ismene Macleana is a fairly rare species with flowers like Calathina, but slightly smaller. The foliage is like that of Amancaes. Although this has smaller bulbs than Calathina it is a very vigorous plant and a prolific multiplier. The scape is about 18″ tall like Calathina, but the smaller blooms are more adaptable for arrangements.

xIsmene cl. Festalis is an elegant pure white hybrid of *Ismene calathina* and *Elisena longipetala.* This is more graceful than Calathina and scapes may go to 36″.

xIsmene cl. Olympia is a supposed cross of *I. calathina* and *I.* cl. Sulphur Queen. This is our largest Ismene. Cream to pale yellow.

xIsmene cl. Sulphur Queen. This hybrid between *I. calathina* and *I. Amancaes,* I consider one of the most beautiful plants I have ever seen in bloom. The scape is slightly shorter than *calathina,* but the foliage is somewhat broader and has a yellowish color like *Amancaes.* The cup is about as large as *calathina,* but has rounded lobes only slightly recurved. It has green stripes in the cup like *calathina,* but opens a fairly deep yellow and gradually pales through primrose and cream to almost white in bright sunlight. This should be a "must" in every garden.

Southern readers will note a particular lack of cultural information in the foregoing article for their locale. However, *Pancratium,* except perhaps *canariensis*; *Hymenocallis* except *Macrostephana, speciosa, Senegambica,* and the Hybrid Daphne; and Ismenes except perhaps *Aman-*

caes, should be hardy where the frost does not penetrate more than an inch or two below the surface and will not reach the bulbs. Since I do not yet have the surplus bulbs to experiment with here, I cannot give the degree of hardiness with authority. To be safe they could handle all as tender bulbs until hardiness is proven.

Cincinnati is approximately on the 39th latitude. Our minimum recorded winter temperature is minus 17 degrees. Temperatures of zero or a few degrees below are not unusual. If these plants will stand the severity of our inland winters and bloom, we may some day see a new race of beautiful hybrids in this group, suitable for growth all over the United States. We know many species will endure some frost, but just

Fig. 20. Left, *Hymenocallis macrostephana,* and right, *Pancratium maritimum.* Photos by Len Woelfle.

how much, we don't know. Perhaps as they become more widely grown, this information will become apparent. In any event, those interested growers who have surplus bulbs which they are willing to chance losing, might do future generations of Americans a favor by making some of their bulbs martyrs to the cause.

All the plants listed in this article and many other rarer, related species are available from scattered growers in this country and at least one importer.

After growing these plants for a number of years, I cannot recommend them too highly to anyone interested in grand flowers with an exotic fragrance. The *Ismene* group is particularly easy. They will grow in any soil that will support the Gladiolus and require only five minutes or so spring and fall to plant them and dig them. They may be thrown into a paper bag over winter and if kept warm they will pay better dividends than any group of plants I know. They seem to be free of disease and as most of them bloom in the spring even the thrips do not get them.

They thrive in full sunlight and will stand partial shade, and as a specimen plant in the border, the foliage after the blooms are gone will stand with the finest the border has to offer. If you want something different, something grand, that will cause a stir of excitement in your garden try them. Given decent treatment they will give you life-long enjoyment. And in a few years you will be able to pass along a few of the bulbs to your frends. I could not think of a finer gift to a gardener than a collection of Ismenes.

For those garden enthusiasts who like to experiment with hybridizing, I believe this is the most fertile field today. Many of the species are fertile at least to their own pollen and further experimentation might develop some interesting variations. The process is slow, but the technique is simple. You won't get hundreds of seeds from one cross and much could be done with little space. Mature plants require, generally, about a square foot of space. I plant mine a foot apart in the garden and they seem to have ample room.

For you who have never grown any of these plants, try them. I assure you you'll be delighted, and if you are a serious gardener, you'll be forever thankful that you have taken that step. You'll never tire of them.

For you oldsters at the game who are familiar with this group, I know you are contented with them, but I would suggest trying some of the newer or different species available today. Dig up your old suppliers and see what they have to offer. It's a safe bet you've overlooked something good.

GROWING ALSTROEMERIAS FOR THE MARKET

BRUCE HINMAN, *Illinois*

Some five years ago we began growing Alstroemerias, chiefly from seeds and roots sent us by Harry Stinson. Since that time we have experimented with most of the *Alstroemeria* species and varieties which are available in this country. This article, however, describes mainly our experience with the two varieties of *A. pelegrina,* and particularly our efforts to sell these flowers to florists for use in corsages and wedding bouquets.

During our first two *Alstroemeria* seasons we sold our few surplus flowers to consumers for table decoration. I had read Harry Stinson's article in the 1942 HERBERTIA, and I had seen the picture of Mrs. and Miss Stinson wearing *Alstroemeria* corsages, but at that time I just wasn't corsage-minded. But shortly after our third season opened, one of our flower customers took some of our white pelegrinas to her florist and asked him to make them into a corsage. She was well pleased with the result, and so was the florist. He became the first of our present list of trade customers, numbering now about 25 florists.

Our operations are not on a large scale, and possibly never will be. We have only a small greenhouse, with perhaps 350 square feet of bed space. However, this area can produce a considerable number of corsage flowers, since we cut the individual blooms only, leaving all the buds to come along later.

The first year that we sold *Alstroemeria pelegrina* to florists in this way, we had only half a dozen customers. Last year we increased this number to ten, and this season—just over on July 1st—we finished with 25. During the same three years we have gradually increased our *A. pelegrina* production until there is very little space left for further expansion.

We had to go out after most of our customers, for florists in general are not in a hurry to try something new in the way of flowers. This characteristic was well demonstrated this season when, for an experiment, we tried to sell some surplus flowers through a prominent Chicago wholesaler. Out of ten medium-sized boxes of pelegrinas, not a single box was sold during a full market day, although many florists saw the flowers displayed. On the second morning I telephoned the wholesaler to give away the ten boxes as samples to ten clients who might be good prospects. He did this, but no one of these trial prospects came back for more, or seemed more than mildly interested.

I had had a similar experience with the Chicago wholesale market during the first year of our attempt to put *A. pelegrina* on sale as a corsage flower. This second trial only proved more conclusively that, for us at least, other ways of getting new *Alstroemeria* customers were better.

Our best way so far has been to take the flowers personally to our prospect, when this is practicable. Our earliest customers were sold this way. In almost all cases we have given away a trial lot of 3 dozen flowers as a starter. If the florist is at all interested in something new for his trade, it is not really hard to get him to try a flower as attractive as either of the two pelegrina varieties, especially if they are free.

This year we added the method of sending trial lots to well known florists in several large cities, chiefly between us (Northern Illinois) and the east coast. These shipments went by air parcel post, special delivery, and in most cases were delivered within 24 hours after mailing. They went to such places as Cincinnati, Toledo, St. Louis, Minneapolis, Boston, and others. We got several new customers by this method, although in some other cases we didn't get any reply at all. However, I feel reasonably sure that some of the florists who made no response may still become Alstroemeria-conscious after another experience or two. Furthermore, we did get enough customers in distant cities to give our packing method a good preliminary test.

Concerning the packing, we cut these single flowers on 1½-inch stems and put them at once in the refrigerator at 40 to 45 degrees F. The storage vessel is a shallow pan provided with a wire tray of ½-inch mesh. The flower stems dip in water through the wire meshes. After 12 hours or more of this hardening process, the pelegrinas can be packed. We don't yet know the best method, but to date the most successful way has been to pack in cartons 3½ inches deep, with enough partitions to insure against shifting of the box contents. A 2-inch layer of shredded waxed paper (orchid straw) is put in each partitioned space. The short flower stems are inserted vertically in this paper, with rather close spacing. We then mist the flowers heavily with water, and cover them with a half-inch layer of the same shredded paper. The flowers themselves are very light and the paper is very light. Unless someone is extraordinarily careless in

handling the package, the flowers get to their address in good shape, usually in 24 hours or less. At the other end, the florist puts them at once in the icebox in some sort of storage tray such as I have described.

When the flowers are handled in this way, they will stay usable a week in the florist's icebox, although they are at their best if used somewhat sooner. We have had some remarkable experiences reported in which the ultimate consumer has worn an Alstroemeria corsage three or more times at intervals of a day or two. In such cases, of course, the wearer needs to give the corsage a little extra care, keeping it in her icebox between times in a closed cellophane bag, plentifully sprinkled with water. But it can be done, and nothing seems to endear a corsage more to a woman than its capacity to outlive more than just one wearing.

We sell these pelegrinas at from $1.50 to $2.00 per dozen individual flowers, depending upon whether the sale is local or involves shipping, with the attendant expense of air postage and special delivery. At these prices the flowers are able to complete on favorable terms with most of the florists' present-day standbys, and their novelty is much in their favor. However, to sell them to the consumer sometimes requires a little extra interest on the part of the retail florist, and some florists just don't want to take the trouble.

Both pelegrina varieties behave admirably when used for personal wear, but the white kind is perhaps a 5 to 1 favorite over the type variety because of the greater adaptability of its coloring. It can be used with more different costumes. However, with the right person and the right dress, no orchid is more handsome than a well-made corsage of *A. pelegrina* (type).

Another circumstance which makes *A. pelegrina alba* the more useful is its great suitability for wedding bouquets. It is a fine wedding flower, as one of our local florists would surely tell you. During the last three years she has used it in more than fifty weddings.

We have run into a number of cultural difficulties, but perhaps those had better wait for some later discussion. Corsage and wedding flowers must be more nearly perfect than those used in ordinary bouquets, and we have had some trouble in holding the quality up to standard. *Alstroemeria pelegrina* grows well in a cool greenhouse, and is highly productive, but there seem to be some definite upper limits for temperature and humidity if the best flowers are to be had. We haven't got all this worked out yet, but we think it can be managed eventually.

Editorial Note.—Mr. Bruce Hinman (Address: Geneva, Ill.) would like to correspond with persons who could direct him to new sources of *Alstroemeria* material.

Mr. Hinman also writes that he has offered in the florists' trade *A. violacea*, *A. chilensis*, *A. tricolor*, *A. psittacina*, and others, but that these were not as favorably received as *A. pelegrina alba*.

COWPEAS—A COVER CROP FOR NARCISSUS PLANTINGS

J. S. Cooley, *Maryland*

In earlier issues of Herbertia the writer has discussed the use of cowpeas as a cover crop for narcissus plantings. In Figure 21 the effect on chickweed if cowpeas or no cowpeas are grown is shown. The narcissus bed shown in the upper part of the picture (above the middle stake) had

Fig. 21. Cowpeas cover crop for *Narcissus*—Upper bed, not cover-cropped to cowpeas, with abundant chickweed; lower bed, cover-cropped to cowpeas in previous season, shows no chickweed. Note that later variety in upper bed shows few blossoms as yet.

no cowpeas for cover crop and when cool fall weather came there appeared a thick stand of young chickweed seedling. In the bed shown in the lower part of the picture cowpeas were sowed as soon as the narcissus bulbs were planted, which was early in July. The thick growth of cowpeas, which lasted till the frost killed the vines in October, prevented

germination and growth of chickweed. The remains of the cowpea vines show in the picture.

The cowpeas not only made unnecessary the laborious task of cleaning out the chickweed, but also helped to enrich the soil by the addition of humus from the decaying leaves, stems and roots. The soil was so mellow where the cowpeas grew that it scarcely needed any cultivation until time to sow cowpeas again. In this region narcissus bulbs start root growth before the time when cowpeas vines are killed by frost. It is possible, therefore, that the cowpeas take up plant food that might be used by the narcissus in the early fall. Cowpea vines and roots, however, disintegrate very readily and their constituents are probably available as food for the narcissus bulbs by the time it is needed. Also in practice we have not been able to note that cowpeas have any harmful effect on flower or bulb production.

NOTES ON THE 1949 DAFFODIL SEASON

GRANT E. MITSCH, *Chairman,*
Narcissus Committee, Canby, Oregon

Last year was unprecedented in its lateness, and 1949 came on the scene with promise of excelling its predecessor in tardiness; however, it relented at the last moment and surprised us by ending the Daffodil season at about the usual date. This shortened the blooming period by several weeks and precluded our getting accomplished some of the things we might have otherwise done. Since these notes are written to meet the deadline for publication and are assembled from a faulty memory, they must be sketchy and rather disconnected; but one (the writer at least) never gets to record even in a normal blooming season what he would like to have for reference later.

The winter and spring of 1949 will be remembered as being one of the coldest and dryest experienced by residents of Oregon. Here in the Willamette Valley, considerably lower temperatures have been recorded than the ten degree minimum of this year but other cold periods have been of shorter duration. The ground was never entirely free of frost for about seven weeks starting from the first of the year. Some Daffodils were up on January 1st and seed were sprouted at that date but growth was at a standstill from then until past the middle of February. At a time when we ordinarily expect cloudy weather, rain and fog, we had more days of sunshine and more days with snow falling than ever before witnessed here. Precipitation was far below normal and consequently most Daffodils were shorter stemmed than usual.

The weather had moderated only a few days until the blooms of that delightful miniature trumpet species, *N. minimus,* opened on February 25th. This was followed in two weeks by a hybrid from *N. cyclamineus* x cl. Magnificence which preceded February Gold about a week. On March 17th we left for California to view Frank Reinelt's planting which, in common with ours, was much later than normal. Here the

flowers were at the height of their bloom. If Mr. Reinelt had done nothing with Begonias and Delphiniums, I am sure he would soon gain renown as a flower breeder through his work with Daffodils. Unlike many hybridists, he is paying less attention to beauty of form and color than to substance of the flower and vigor of the plant. He is not neglecting the former but giving more attention to attaining the most difficult goals

Fig. 22. Left, *xNarcissus* cl. COTTERTON; right *xNarcissus* seedling (cl. CUSHENDALL x CANTABILE). Photos by Grant E. Mitsch.

first, and numbers of his seedlings testify to the correctness of his methods. Aside from this general plan, he is attempting to develop varieties particularly suited to California climatic conditions. We saw numbers of outstanding things from Polindra crosses, and more recently he has been using Trousseau, Galway and his own seedlings as parents. One seedling of his in particular, Loma Prieta, seems to have the faculty of im-

parting substance to its offspring. Our visit to Mr. Reinelt's place was a highlight in the 1949 Daffodil season.

On reaching home a week later we found numerous early flowers opening, most of them being seedlings. Rains coming while we were absent and more light showers the next few days helped the blooms considerably but there was not enough moisture for the best development of the flow-

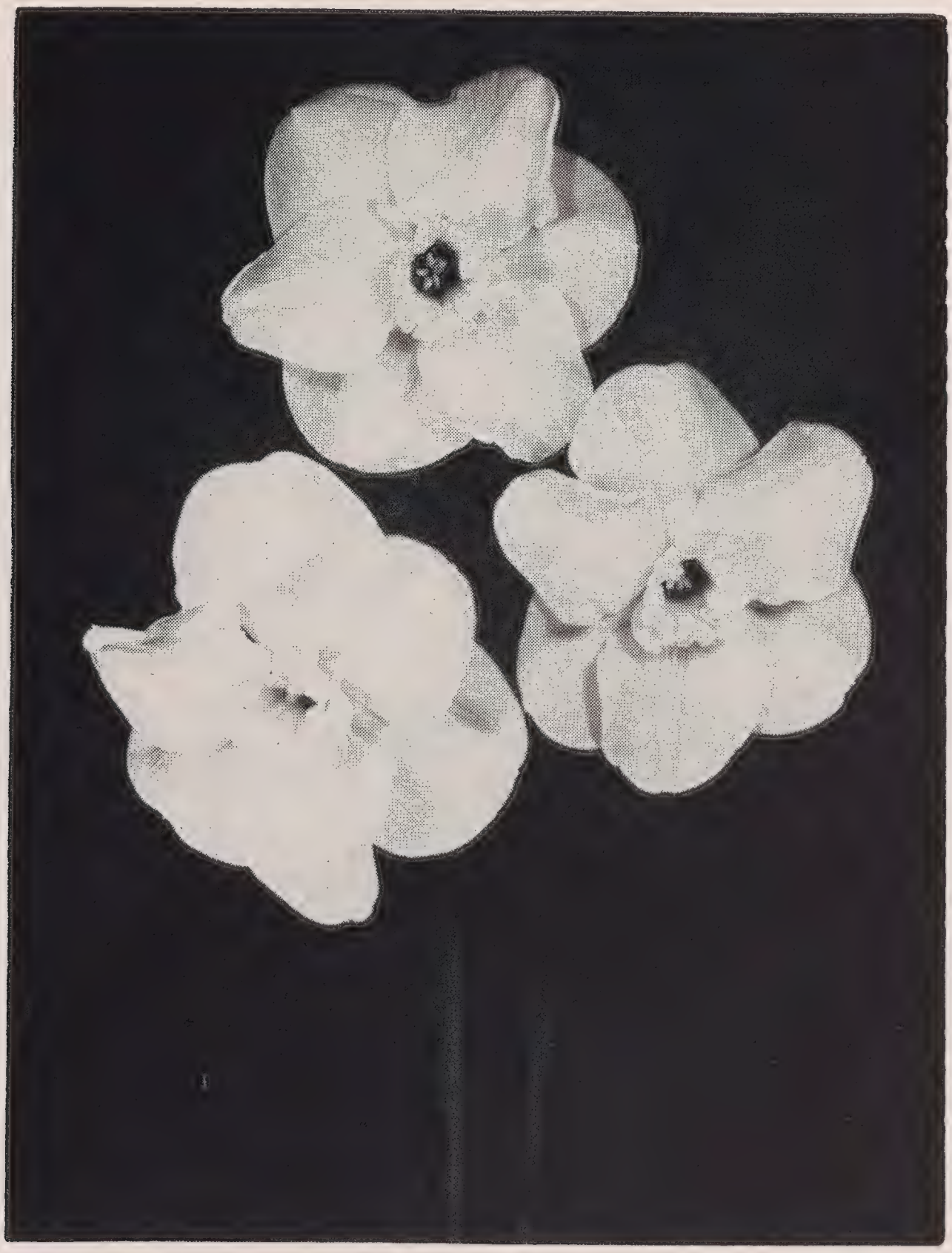

Fig. 23. *xNarcissus* cl. Foggy Dew. Photo by Grant E. Mitsch.

ers, particularly those planted on light soil. Clearing skies and higher temperatures brought the blooms out with such rapidity that it was impossible to keep pace with them. From the time they got well started, there was no rain, little wind and not much cloudy weather until the very late poets and small crowned leedsiis were in bloom. There were few hot days but many with warm bright sunshine in which the white flowers

reveled, Kanchenjunga giving huge blooms of finer quality than I had seen before. Cantatrice was nearly perfect as usual, and Coolin was lavish with very large, finely formed, very white blooms. Truth was exceptionally good. Possibly our favorite of all the whites is Ludlow, which has very broadly overlapping perianths of much substance which become very pure white as they age. The huge snowy white Zero is striking as it is one of the first of the big whites to bloom. The immense tall stemmed blooms of Broughshane come a little later than most of the whites and usually get caught by inclement weather but we were permitted to enjoy them more this year. Pearl Harbor remains one of our favorites as a garden flower. Incidentally, we had a number of magnificent huge white seedlings this year from Pearl Harbor x Kanchenjunga. Cotterton (Fig. 22) is a delightful finely finished rather small flower and among other whites looking good this past season were Evening, Carnmoney, Rostov, and Moray. Ludlow has already been mentioned as a great favorite of ours, but going to another section with flowers of entirely different form, we think Chinese White (see HERBERTIA 1947, Plate 290) one of the most lovely of all Daffodils. It does hang its head when first open but it is an exquisitely lovely immaculate flower. Foggy Dew (Fig. 23) and Glenshane are of somewhat similar character with somewhat more substance but less purity than Chinese White. Then there are Tinsel, Sylvia O'Neill and Moina with colored rims on their chalices. Some of the smaller flowers of the same type are no less lovely, and the enchanting beauty of the green eyed blooms of Cushendall, Frigid, and Polar Sea must be seen to be appreciated. We had three or four most dainty and lovely small green eyed seedlings from Cushendall x Cantabile (Fig. 22). They are so cool and ethereal in appearance as to be almost unreal. For cutting they are unmatched but in a warm room they are as with other Daffodils, all too short lived! If one tires of the larger flowers by the time the season ends, these fairy flowers will renew one's enthusiasm.

Daffodils with pink coloring are among the most intriguing and at the same time among the most unpredictable. Breeding pinks is one of the most fascinating phases of narcissus hybridizing but one fraught with many disappointments and surprises. We are quite amazed to see some varieties which are usually possessed with strong coloring come pale and washed out this year whereas others exhibited more intensity of pinkness than normal. The rather old, and most familiar of the pinks, Mrs. R. O. Backhouse, showed rather more coloring than normal whereas Wild Rose was very faded and not its usual self this year. Heretofore, for depth and clarity of coloring it about topped the list. Even the richly colored Mabel Taylor was hardly as striking as usual although it still drew perhaps more attention than any other of the pinks. Interim, with its wide band of rosy salmon pink, is one of the larger and better formed of this class but was deficient in coloring this year, as were also Lisbreen, Ischia, Rose of Tralee, and several others. On the other hand, Lough Maree displayed much more coloring than before. It is quite a good sized flower and a vigorous grower although not quite so fine in form as one would desire in an exhibition flower. For good size, nice form, and luscious coloring Dawnglow and Rosario excelled all others this year. Per-

haps next to them was a seedling of quite different form having a ruffled very frilly trumpet crown with nice soft pink coloring throughout. It had bloomed twice before but its three blooms this year were better than previously. Some of those which were better last year were not as fine this time as this one which came from Shirley Wyness x Pink a Dell. Among the first Mabel Taylor seedlings blooming this year were some with good color but very poor form. Of course they may improve when grown from larger bulbs and doubtless there should be much better ones when they bloom in larger numbers another year. We hope that before

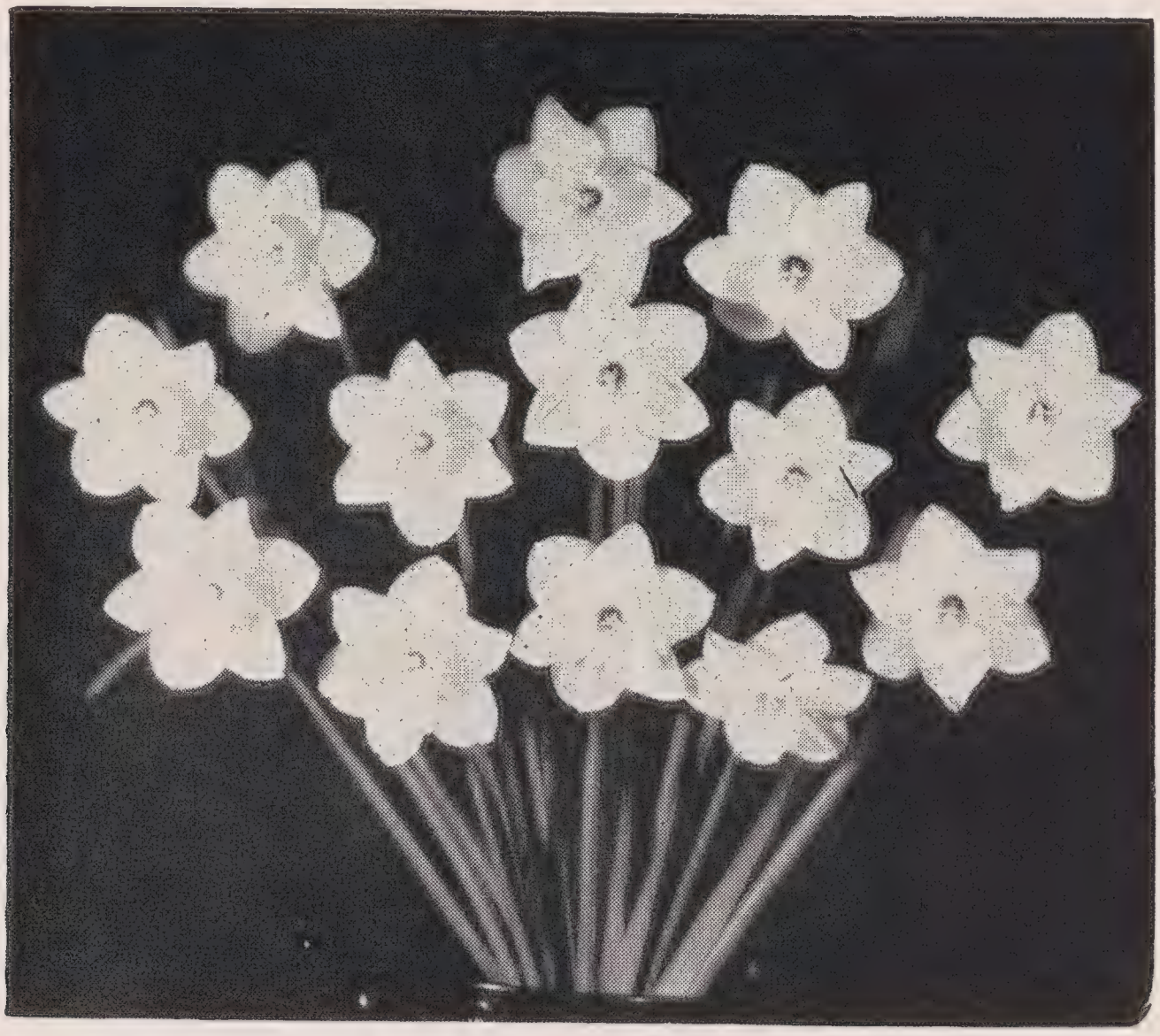

Fig. 24. *xNarcissus* cl. BINKIE. Photo by Grant E. Mitsch.

too long there may be a pink Daffodil combining the best qualities of the pinks that we now have coupled with an ability to retain this coloring under various soil, weather and climatic conditions.

Some of the red and orange cupped Daffodils are quite as fickle as the pinks while others can be depended upon to give good color and good performance generally. Even these will surprise one occasionally as did Porthilly, which appeared with virtually no coloring two years ago. Even in this season which was rather unfavorable to red cups, Porthilly had quite rich orange crowns. Although not a very large flower, Narvik has been unsurpassed for quality and coloring. Krakatoa is the most striking at its best but is rather variable in performance. Although it fades somewhat more quickly in the sun than some other varieties, Indian Summer has very rich deep coloring in both crown and perianth, the

latter being an intense golden yellow. Sun Chariot of similar coloring is larger and of quite different form, having longer petals and a more flaring crown. Royal Ransom consistently gives good blooms of excellent form and unique coloring, the perianth being rich buff and fading lighter. Unfortunately it is not too vigorous in growth here. One would not want all their flowers to be of formal exhibition form but the very rounded flat overlapping perianths of such varieties as Hugh Poate, Garland, Chungking, Dunkeld and Tamino have an especial appeal to one who likes perfection in form. The first named is the largest and strongest growing of the lot but has least coloring in the crown. Diolite with its smooth finish and fine form has long been a favorite, and Red Riband with its very distinctly orange banded crown was very fine this year.

Fermoy and Kilworth are two of the best whites with red crowns. The former is very large and of good form, the orange red of the crown shading to gold at its base. Kopriva strikes a new note by giving us color earlier in the season. In Tuskar Light we have a very large flower with a distinct orange banded cup, a very striking flower. Most of the red and white flowers belong to the barrii section. Of these, Limerick is about the best, it having held its color well even this year with the dry warm sunshiny weather. Bravura, Matapan, Otranto, Paprika, and Teboura are all worth while and Crete gives some of the finest blooms of all but is not quite as highly colored. Although not a red cupped variety, Blarney might be considered here. It is a most lovely thing with its yellow rimmed salmon orange crown. Apparently it does not thrive in all sections.

Yellow is generally thought of in connection with trumpet Daffodils yet most of the best yellows are not of trumpet proportions. Our first choice would go to Galway although some years Golden Torch is fully as good. Balmoral is unexcelled for perfection of form and smoothness of texture but it is not quite equal in length of stem and substance to the other two. Perhaps the largest and one of the most striking yellows is Shanghai. Of the trumpets, Kingscourt was perhaps the best last season. Camberwell King was not as good the past two seasons but has in the past given us blooms equal to any we have grown of any yellow variety. Frontier and Moonstruck looked good, the latter in particular being a very large sulphur toned flower. Among our seedlings from Content have been numbers of those greenish toned flowers, several of very good quality. Content has proven very valuable for breeding and was quite marvelous itself this year. Its huge graceful blooms opened with a luminous cool sulphury coloring that soon faded to its accustomed "lemonade" hue. Binkie (Fig. 24) was superb, being a most satisfying cut flower and should in time become a splendid commercial variety.

Good bicolor trumpets are still not plentiful. Spitzbergen gave superb large perfectly formed flowers of pale coloring. Trousseau and Trostan were good again as usual. It is difficult to surpass Sincerity for quality although one could wish it were a bit larger and considerably taller. We were much pleased with the very early flower, Foresight, this year. Although short on first opening, it lasted a long time and continued to grow in height.

We are still unwilling to discard Bodilly and Polindra in favor of any of the new bicolor incomparabilis although Statute, Tramore, and several others look good. Bodilly is always good but we had never had such fine blooms before as from some bulbs planted in a display bed two years ago. Coverack Perfection was outstanding this year and we had quite the largest blooms of Gold Crown that we have grown. This one seems to have possibilities for breeding if we may judge by a few of its seedlings bloomed this spring. Rubra provided us with beautiful cut blooms as well as supplying material for hybridizing. A number of its seedlings from Sylvia O'Neill pollen were of entrancing beauty. Rubra is among the most prolific seeding of all Daffodils, apparently being receptive to the pollen of most other varieties and making a larger number of seed per pod than anything we have used other than some of the poets.

Silver Chimes came through the winter and bloomed in spite of the cold and its reputed tenderness. Of the jonquil hybrids Trevithian was again the finest and Cantabile the most attractive of the poets. Although the season was unfavorable for many varieties, yet we had quite a lavish display of beautiful blooms, again proving that the Daffodil is capable of performing under adverse circumstances.

NARCISSUS IN A MARYLAND GARDEN

W. R. Ballard, *Maryland*

The season of 1948 was rather favorable for narcissus in my garden. No attempt was made to keep an accurate record of dates of bloom but from breeding notes, it appears that the following varieties were in bloom on March 30: Ada Finch, Stresa, Beersheba, February Gold, Fortune, Unsurpassable, Magnificence, Carlton, Miriope, Gertrude Millar, and Carmencita. Other varieties were undoubtedly in bloom on this date but no record was made of this fact.

By the 5th of April several other varieties had blossomed. These include Roxane, Central Park. Lovenest, Giant Perfection, Tunis, John Evelyn, Johanna, Francisca Drake, Ace of Diamonds, Forerunner, Lady Hillingdon, Suda, Firetail, Damson, General Pershing, Golden Goblet, Honey Boy, Lanarth, Dawson City, Tredore, Shererasade, Trevithian and Sonja.

By the 12th of April additional varieties in bloom included Salembo, Mayflower, Cheerio, Beryl, Whiteley Gem, Apotheose, Golden Perfection, Mildred Haven, Porthilly. Lucinius, Irmelin, Alcida, White Wedgewood, Great Warley, and Shot Silk.

The last notation recorded was made on April 26th when Silver Chimes and Bulbocodium were listed. Other varieties in the parade since the middle of the month had been Moonshine, Mystic, Mrs. R. O. Backhouse, Green Mantle, Cheyenne, Agnes Harvey, Thalia, Silver Salver and Tagore.

There were undoubtedly many other varieties in bloom at various periods, but these were the ones used in crossing, and it is to be assumed that these appeared at the time to have had certain characteristics which

were thought to have value from a breeding standpoint. Without having made careful descriptive notes at the time they were in bloom, it is not easy to recall outstanding performances. Much depends upon the culture given as to how the different varieties develop.

Since my soil is rather heavy clay and none too fertile, it has been necessary to improve the conditions. To improve the entire area to the extent required seemed too great an undertaking so a compromise was arrived at. This was done by simply digging out pockets a foot deep where the bulbs were to be planted and this was filled with a soil consisting largely of leaf mold. The portion below the bulbs was liberally fertilized with pulverized sheep manure to which a small quantity of a 5-10-5 fertilizer had been added. This may not be the orthodox way to do, but it seems to have worked. Not only have the flowers developed satisfactorily but the bulbs have increased so rapidly that the clumps have had to be dug up and separated every four or five years.

The following varieties are a few of those which performed well for me. Considering their size, vigor and permanence, Unsurpassable and Magnificence seem to have the lead among the early yellow trumpets. Apotheose has been remarkable for substance of flower, but it has not bloomed as freely as could be desired. As far as color, substance, and carriage are concerned, General Pershing, a Jonquil hybrid, is a prize. However, in the two years it has been in my garden, it has had only one flower. So far it shows little inclination to multiply. If it presently shows a tendency to overcome these shortcomings, it is easy to see that a large clump in bloom would surely be outstanding. The flower stem is strong, holding the flower up-tilted, and usually has been about two feet high. Fortune is the only representative of this strain in my garden, but it has consistently performed well.

Of the white trumpets, Ada Finch has been the tallest, the flower is large, and it has been generally satisfactory. Roxane has done well but the stems are only medium in height. Stresa is another large flowered white which has done well. Gertie Millar and Daisy Shaffer are two of the Giant Leedsii whites which have been quite fine. Lovenest and Mrs. R. O. Backhouse have been in the garden for several years. They both flower profusely and the bulbs have made good increase. Mystic, a pink Leedsii, is a weak doer and last year was the first time it has had strength enough to bloom. Beersheba is quite distinct in form, a pure white in color, and it has a distinct record of good performance.

The medium and small flowered types may not be as showy as the large trumpet varieties, but they are in some respects more intriguing in the garden. Some of those which have added interest and charm to my garden are John Evelyn, Tunis, Sonja, Gallipoli, Mayflower, Actaea, Silver Chimes, Shot Silk, Green Mantle, Triandrus alba and the Bulbocodium.

The double varieties have not had too great an appeal although Daphne and Cheerfulness are attractive. It is true that some of the more recent introductions are improvements over some of the older varieties. Holland's Glory, Royal Sovereign and Texas bloomed in my garden last year and they are rather pleasing.

It is not always easy to provide congenial growing conditions for Narcissus species, but they add much to the interest of the group when they can be made happy. Unfortunately it seems to be very difficult to find available stocks in this country of the many charming sorts described in the literature. It would be interesting to try some of the fall blooming sorts, if bulbs could be procured.

In relating the season's experiences with narcissus, no attempt has been made to evaluate critically the parade of varieties, but more especially to record the sometimes clear but often vague impressions of the floral display as it passed in review.

NARCISSUS NOTES, 1948

J. S. Cooley, *Maryland*

The narcissus at my place began blooming in 1948 on March 20, which was a week or more earlier than usual. As is generally the case, the differential in time of blooming of the early group of varieties was rather slight—there being only a day or two from the time of blooming of the earliest to that of the next earliest variety. Usually *N minor* is the first to bloom here but this year it was preceded by Henry Irving. The order of blooming was Henry Irving, *N. minor,* February Gold, Obvallaris, Forerunner, Golden Harvest and Alasnam.

The weather was such this year that one had a chance to observe some of the conditions making for red color in narcissus. Just as blooming started (March 21) there was a heavy rain followed by cool weather, and on March 26 the temperature was low enough for the ground to freeze. The weather continued on the cool side throughout the blooming period, which lasted well into May. Frequent rains gave adequate moisture. The color of those varieties having some orange in the cup was very beautiful. Fortune, which bloomed here during the cool moist period, was very pleasing. On the other hand a friend of mine living a little farther south grew his Fortune where it bloomed about a week earlier than mine. Its color was poor, having little orange in the cup. The weather had been dry and warm (some days as high as 85) prior to blooming of his plants. The evidence this year as well as in previous years indicates that adequate moisture and coolness are conducive to the formation of the beautiful reddish orange color of the cups of narcissus. In this locality the weather is often warm and the soil more or less dry by the time the red-cupped varieties come into bloom. There is often so little red in the cup that one might think the variety he purchased for a red-cup variety is mislabeled and does not correspond to the description. Red Cross for instance is often of very poor color. Some other varieties having red in the cup such as Dunkeld and Ace of Diamonds may fade badly in a hot period. The weather limitations on growing narcissus in this locality probably help to make one appreciate still more the beauty of those varieties making no claim for redness in the cup. The color of a plain yellow, such as Dawson City, is finer than that of an orange-cup variety where the orange does not develop, as is sometimes the case with

Red Cross. Fortune, for instance, some years gives one the impression of being a much overrated variety. With these climatic limitations on the growing of certain varieties of narcissus, it would seem that the breeders would do well to put more emphasis upon finish, substance and "do-ability" rather than upon some red frilling to the cup that may often be absent or nearly absent.

In 1946 and 1947 a condition obtained that enabled us to get some information on the passing out of certain varieties between the yearly growth periods. It is a matter of common observation that many of the plants of certain varieties often fail to show up the next spring. This may be very disconcerting, especially if the plants had been recently acquired at some expense and planted with great hope and anticipation. In 1946 I acquired about 25 plants of Daisy Shaeffer. They were planted out in October. The next spring there was a good but not perfect stand of fine plants having beautiful blooms. The bulbs were not dug that summer but were left undisturbed in the soil with the expectation of having fine increase by next year, but none of them showed up in 1948. Because the flowers were so fine and attractive in 1947 twenty additional plants were acquired and planted in October 1947 in a bed adjacent to those planted in 1946. Those planted in 1947 gave a good stand in the spring of 1948 and produced fine flowers. Those bulbs of the 1946 planting that remained in the soil in the summer of 1947 failed to appear in the spring of 1948. When a clump of narcissus passes out it is usually blamed on some unfavorable winter condition such as excessive wetness or low temperature or the one bad condition in conjunction with the other. The condition reported above with Daisy Schaeffer indicates that some condition in summer of 1946 rather than a winter condition in 1947-48 was the important factor in the passing out of that variety. In the summer of 1948, in order to prevent the Daisy Schaeffer bulbs from rotting during the summer, they were dug in July soon after the tops died. At the time of digging some of the bulbs were rotten and most of them showed signs of rot starting. These bulbs had been planted in fertile, well-drained soil where narcissus had not been grown before. Furthermore, bulbs of other varieties planted adjacent to the Daisy Schaeffer showed no evidence of rotting or of basal rot when dug at this time in July. This as well as other experience indicates that if one lives in a region of moist summers he would do well to discriminate against those varieties that often pass out from one year to the next. Certain varieties of the white trumpet and Leedsii classes are most likely to pass out. Among them are Daisy Schaeffer, Roxanne, White Emperor, Silvanite, Mme. Van Waveren, Mrs. Krelage. Among the yellows are Pacific Spur, Golden Spur, Henry Irving, Diotima, Carlton, Orange Queen, Abelard. It may be advisable therefore to dig every year as soon as the tops die those varieties that often pass out or that are important in one's breeding program. Some disinfectant treatment such as dusting as soon as dug with Arasan or Spergon (McClellan, W. D. Phytopathology 38:17. 1948) may also be advisable to help prevent rot during the summer. An effective method consists of shaking the bulbs in a paper bag with some of the Arasan dust. (The necessary precautions should be exercised in handling these

poisonous compounds.)

After giving as near optimum storage conditions as possible the bulbs should be planted in October or at the time when conditions are favorable for root activity to start at once. Such a procedure would prevent the inactive bulbs from being subjected to conditions that are conducive to rotting.

The cool moist weather in April, May and early June 1948 should have been very favorable for the development of strong bulbs and a good crop of flowers next year. Last year and the year before, weather was unfavorable for the development of flower buds; consequently those plants that were in some unfavorable situation because of competition with other plants or overcrowding gave very few and poor flowers, while those plants that had adequate room in a fertile soil bloomed freely.

SOUTH AFRICAN AMARYLLIDS AS HOUSE PLANTS

[Continued from 1948 HERBERTIA]

SARAH V. COOMBS, *New York*

I. BRUNSVIGIAS

Brunsvigia rosea (Lamarck) Hannibal (syn.—*Amaryllis belladonna* Ait., non Linn.; *Coburgia rosea* (Lamarck) Gouws). Commonly known as the Cape Belladonna Lily, and as Maartlelie (March Lily) in South Africa. Though this lovely flower is now to be known as *Brunsvigia,* it may still be called Cape Belladonna. The ways of botany are sometimes hard for an outsider to understand, yet they must be followed for scientific accuracy. It will come easily to call this flower a *Brunsvigia,* especially as the name makes many of its hybrids no longer bi-generic, with many crosses now within the genus. The story of this flower is a puzzling one. It is with great diffidence and modesty that I embark on it.

The Cape Belladonna is not found on Table Mountain only in South Africa but it is definitely a plant of the South African winter rainfall area of the extreme southwest Cape, while crinums and other bunsvigias with which it has been crossed are found in the eastern and northeastern section of summer rainfall. So far as the subject seems to be recorded, crossing of the Cape Belladonna does not take place naturally with nerines or haemanthus, other amaryllids, though they live in the winter rainfall section and bloom at the same time, in some cases.

Brunsvigia rosea blooms in California fairly early in September and October yet in the way of many South African plants it is adjustable, making it useful as a house plant. This is especially true as they bloom at home in February, March and April. Different times of blooming are noted particularly in the hybrids. Different times of starting bulbs, different times of watering, have much to do with time of blooming.

The wild species may be pink in color or white with a streak of yellow at the base of the segments. The deeper tint of the pink shows in those growing in partial shade. The stamens are white, tinted pink when young; the style is white at base, pink above, with small purple stigmas.

This flower is nearly hardy in the New York area and may grow and bloom if planted in a sheltered spot with good drainage, deeply set and covered with a mulch in winter. In the New York Botanical Garden, it is planted against a greenhouse and blooms in late summer. The hardiest of all is the variety *purpurea major.*

There are different forms or species known as var. *major* (early flowering), *minor, bicolor.* The origin of these bulbs is obscure and no mention of similar specimens has been found in European literature, though they resemble the ones grown in Mediterranean gardens. Hannibal says that *''major''* is apparently an intermediate between the type and *spectabilis bicolor* Sprenger, while *''minor''* is a small form of *B. rosea.* In southern California, where the climate suits them, they grow almost like weeds; the ones best known there are the pink forms. The variety or hybrid introduced much later and known as *xBrunsvigia multiflora alba* is most valued, perhaps because more beautiful and certainly rarer. The white forms are greatly prized by the bride, who carries them up the church aisle. These may be hybrids of the group produced by Bidwell of Australia between *Brunsvigia rosea* and *B. grandiflora* Lindl and known as *B. multiflora, B. multiflora alba* and *B. multiflora rosea.* Of the ''Belladonna Lily'' proper, there are many forms of which *''rubra''* is the brightest of the *multiflora* type. The parentage is uncertain but the type is good. They are known to have sometimes 30-40 blooms on a stalk and to remain in bloom for a long time. A fine named variety of the *multiflora* type, Haythor, raised by Bradley of Australia, said to be a seedling of *B. rosea* and *multiflora alba,* is a lovely pure white with a small orange-yellow eye. It has ruffled petals with a crinkled edge and increases quickly. Hannibal thinks that one parent was a Bidwell *multiflora* hybrid (*B. grandiflora* x *B. rosea*) and the other may have been *Parkeri* (*B. grandiflora* x *B. rosea*). Cowlishaw thinks it is a good form of *B. Josephinae* crossed with *B. multiflora alba.* Other good hybrids of the multifloras are Harbord, a fine white, and Orvieto, a deep pink. *B. multiflora* Ait. is considered by Baker, in Amaryllideae, a synonym of *B. gigantea. B. Parkeri alba* is especially fine.

A cross between *B. rosea* and *B. Josephinae* (*B. gigantea?*) produced the variety *Parkeri.* It has a very tall spike, many, sometimes 16-20 flowers per umbel. The color is a pale rose. The name is used for another crossing by a different producer.

The species has one botanical variety, *Brunsvigia blanda,* though Baker gives *A. pallida* Red., which is included also in the Royal Botanical Hand List. Var. *blanda* has appeared and disappeared, coming back perhaps as different forms or natural hybrids. It is distinguished from the so-called Cape Belladonna by longer, wider, more substantial leaves, with a pseudo-stem and late-blooming tubular flowers. The flowers are white and turn to very pale pink, later to clear pink. Allied forms, now *B. rosea* var. *rubra* (syn. *A. rubra major* of J. E. Elwes) and the variety *purpurea major,* are only partly deciduous and have a pronounced pseudo-leaf. This last is free-flowering, with many flowering umbels and hardy, with full protection. It has several stalks. The flowers of *rubra* are the brightest pink or crimson with a yellow base while those of *pur-*

xBrunsvigia Parkeri cl. ZWANENBURG

[Reproduced from HERBERTIA 2: plate on p. 113. 1935; original photo C. G. van Tubergen Ltd.]. See page 134.

Plate 9

xCrinodonma Corsii cl. FRED HOWARD (syn.—*xAmarcrinum Howardii*).

Plate 10

purea major are carmine, also with a yellow base. These two hybrids are large robust plants.

The variety known as *purpurea major* has been much used in Dutch nurseries. This is known in French gardens as *rosea-perfecta.* It is a good bloomer. Australian breeders have done much work on this group. Breeders there have grown many hybrids between *B. rosea* and *B. Josephinae,* as others have done, but they have had a splendid start on the growing and produced much that is interesting. The work continues in several countries with various hybrids, with fine results. The variety *purpurea major,* crossed with *Parkeri* and *rubra major,* has given a number of varieties. Many of these bulbs produce strong stems and large, lily-like flowers, colored a pink or deep rose-carmine. Among these are the Van Tubergen varieties, Barberton, Jagersfontein, Lydenburg, Pretoria and Windhoek. These growers have great hopes of a cross made between a *B. rosea* and the orange colored *B. gigantea.* It needs great patience to work with these flowers, as Brunsvigias are in no hurry to bloom. They will be worth waiting for.

The hybrids known as Brunsdonnas cover crosses between *B. Josephinae* as seed-parent and *B. rosea* as pollen parent. A splendid hybrid of this crossing has violet-pink flowers and is known as *xBrundsdonna Tubergeni.* The hybrids Haythor, Harbord and Orvieto are usually called Brunsdonnas. This name is used for other hybrids and will have to be settled as to its rightful naming. It may be necessary to furnish another name, if there is controversy. Bailey uses the name for both crosses. There is a splendid lot of material and well qualified growers.

A chance seedling found in an old California garden has been named Frank Leach. It represents one of the better Cape Belladonnas. The flowers open white but turn a warm pink.

Cultivation of Cape Belladonna and Hybrids. Soil conditions are not critical. Any good loam suitable for roses is excellent. Sand is desirable when added to loam but there should not be too porous a condition, though drainage is important. Though the bulbs resent frequent transplanting and some of them are said gloomily not to do well in a pot, they sometimes like to spend their first phase in making extra bulbs instead of blooming and these should be separated and given a chance with extra richness, to bloom by themselves. When later, they are crowded with roots, the trouble seems to be over and they will bloom till they almost burst the pot or tub. In outdoor planting, they are set rather deeply, to avoid possible freezing and too hot sun in summer. For indoors planting, only ⅔ of the bulb should be covered. *Parkeri* and its allies need a rather lighter soil and a warmer location. If outdoors, a rather shallow planting may be suitable with a ground cover to protect the bulb from too much sun. Some shade is suitable.

These bulbs need a good ripening. While resting indoors, pots may be laid on their sides with a cover of salt hay or other material. It is the experience of this writer that to set the pots on their sides under a bush during the summer, where occasional rains keep from too dry conditions, seems to produce better results, for this is more like their native conditions. When growth is wanted, watering may be started, lightly at first.

later more abundantly, kept up until signs of resting show by the drying of the leaves, when watering is gradually withheld.

Different soils have little or no effect on color variations but intensity of light is important. Deepest color is found in shady locations. Bone meal is a help, also wood ashes, but adding chemical fertilizer of known reliability or liquid manure will show good results during growing time. Cool conditions are best for them.

Other Brunsvigias. My consideration of the other Brunsvigias as house plants will be published after Dr. Dyer's monograph on the genus *Brunsvigia* has been published because the nomenclature is somewhat confused at present.

II. xCRINODONNA

The bigeneric hybrid, known as *Crinodonna Howardii* (syn. *Amarcrinum Howardii*) is greatly admired by anyone who has seen it. It is the result of the crossing of two amaryllids, *Crinum Moorei* (pollen parent) and *Brunsvigia rosea* (seed parent). It was produced by Mr. Fred H. Howard of Los Angeles, California, who had had a reputation for years as a keen plant breeder, especially of roses. It received the award of the Cory Cup from the R.H.S. in London in 1926. That award goes, I believe, to what is considered the best new plant of the year.

Though it is a flower of surpassing merit, it is rarely seen in cultivation, perhaps because it increases rather slowly, though it may be doubled in a year. In California gardens, where it lives out of doors, it blooms normally from early August till late October. The delicate, lovely rose-pink flowers are like those of one parent, *Brunsvigia Rosea*, but it has foliage like the Crinums. There are often from 16-20 flowers to a stalk, opening in succession so that it lasts at least a month. It is quite fragrant. The flowers have an open funnel-form with recurving segments and declinate style. The clusters are large on stems from 2-4 feet high. It is one of the most satisfactory of amaryllids for pots and for gardens. It is said to be recurrent blooming in California gardens. A robust, evergreen bulb, it is called by one admirer "an absolutely first-class plant." In pots, it may take a little time to start blooming but if it is like the other crinums, once started, it will bloom on for many years without a break. It may be planted late for winter blooming, being amiable, like so many of the South African amaryllids in that way.

An earlier hybrid of similar parentage has been called *xCrinodonna Corsii.* It was raised in Italy and is probably not in cultivation in America.

This bulb has conditions of cultivation like the Crinums. It needs more moisture. In pots, only the base of the large bulb should be covered. It needs some shade, which it is likely to have in house situations.

[The third installment of this article will appear in a later number of HERBERTIA.]

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[Members of the Hemerocallis Jury are *ex officio* members of the Daylily Committee]

REGISTRATION OF DAYLILY NAMES—Registrars: Prof. J. B. S. Norton, *4922 40 Place, Hyattsville, Maryland,* and Mr. W. R. Ballard, *5102 41st Ave., Hyattsville, Maryland.*

[Correspondence about priority of Daylily names should be sent directly to Prof. Norton, *but a self-addressed, stamped envelope should be enclosed if a reply is expected.*]

DAYLILY JURY (For evaluating Daylilies)—Prof. L. H. MacDaniels, *Chairman, Cornell University, Ithaca, N. Y.*

Those in charge of Official Cooperating Trial Gardens are *ex-officio* members of the Daylily Jury.

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Mr. W. Quinn Buck, in charge of Daylily Trial Garden, Div. of Ornamental Horticulture, University of California at Los Angeles.

Note: Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practical each trial garden will publish, in HERBERTIA, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

DATA CARD FOR HEMEROCALLIS

When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and full described in HERBERTIA, Vol. 7, 1940, and Vol. 14, 1947. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

For information write to—

Mr. E. Frederick Smith, Membership Secretary,
The American Plant Life Society,
Box 2398, Stanford, Cal.

SCORE CARD FOR HEMEROCALLIS

For the official score card for Hemerocallis see HERBERTIA, Volume 7, page 126, 1940. Reprinted in Vol. 14 (1947), page 37.

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FLOWER TYPES AND SCORE CARD FOR HYBRID AMARYLLIS

For classification of flower types and score card for Hybrid Amaryllis see HERBERTIA, Volume 5, pages 141 to 145, 1938.

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[CORRIGENDA: DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, continued from page 90.]

In several places there is a dash (—) after "syn.," or "err.," which should be "=."

Any errors in publication dates of HERBERTIA may be corrected from the data on page 15 of the DCH.

Page 22, preceding "Aurora, l. hom. = Borealis.," insert "Aurora (Perry, 1946), Perry c. ?. (105)."

Page 41, for "Gen" read "Gem."

Page 42, (881) "Golden Emperor" is out of alphabetical order.

Page 58, (1462), for "Walgren" read "Walgreen."

Page 60, (1534), for "Nicolette" read "Nicollette."

Page 63, (1634), for "Hb. 15" read "DCH."

Page 69, (1882), for "Ringleto" read "Ringlets."

Page 73, for "*Serotina*" read "*serotina.*"

for "*H Thumbergii Bark.*" read "*H. Thunbergii* Barr."

Page 90, (2691), for "Rev." read "Rex."

The date of publication for some Perry clones may be earlier than 1946, the date of his DIARY, which is the earliest seen by the compilers.

Other corrigenda have been recorded, chiefly typographical errors, and minor changes in descriptive data, which are available for future supplemental editions. Some of the more important, not as yet edited, are to appear in the 1950 HERBERTIA EDITION of PLANT LIFE, vol. 6.

POSTSCRIPT NOTE (Hemerocallis).—By cooperative arrangement with THE HEMEROCALLIS SOCIETY, completed as of Nov. 17, 1949, descriptions of only such *xHemerocallis* clones for which the 50c registration fee has been paid to the Registrar of THE HEMEROCALLIS SOCIETY will be published in this department beginning in 1950. This applies only to *xHemerocallis* clones for which the fee should be sent directly to Mr. Earl A. Holl, Registrar, THE HEMEROCALLIS SOCIETY, 3520 North Grant Ave., Indianapolis 18, Ind. All registered clones will bear a number (example: 3322-R). The number "3322" indicating the number of the clone and the "R", the information that it is registered.—J. B. S. Norton

NOMENCLATURE OF SOME BRUNSVIGIA HYBRIDS

HAMILTON P. TRAUB, *Maryland*

xBrunsdonna represents certain intra-generic crosses involving *Brunsvigia* species (See AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Traub and Moldenke. 1949, p. 66.) and therefore is a synonym of *Brunsvigia* Heist. Such crosses are properly indicated as *xBrunsvigia* with an appropriate secondary epithet, the "*x*" indicating intra-generic hybridity, and the secondary epithet the particular two species crossed, including reciprocal crosses.

Genus **xBrunsdonna** van Tubergen, in Gard. Chron. Lond. Jan. 23, 1909, p. 57, fig.; Worsley, Gard. Chron. Nov. 14, 1925, pp. 391-392, f. 164; Worsley, in Jour. Roy. Hort. Soc. *51*: 64-67. 1926. = **Brunsvigia** Heist.

xBrunsvigia Parkeri (W. Watson) Traub, **comb. nov.** Syn.—*xAmaryllis Spofforthiae* Herb. Amaryll. 278, 425. 1837, nomen; *Amaryllis Parkeri* W. Watson, in Gard. Chron. Lond. Feb. 6, 1909, p. 92; *50(2)*: 210, fig. 101. 1911; The Garden, *75*:462, fig. on p. 460. 1911; Worsley, in Jour. Roy. Hort. Soc. *51*:66. 1926; Hoog, in HERBERTIA *2*:113-114, pl. on page 113. 1935; *xBrunsdonna Parkeri* (W. Watson) Worsley, Gard. Chron. Nov. 14, 1925, pp. 391-392, f. 164; Worsley, in Jour. Roy. Hort. Soc. *51*:66, 64-65, 67. 1926; *xBrunsdonna Sanderae*, Gard. Chron. *50(2)*: 210. 1911; The Garden *75*:462. 1911.

Here belong all crosses involving *Brunsvigia Josephinae* Ker-Gawl. (syn.—*B. gigantea* (van Marum) Traub, non Heist.) and *B. rosea* (Lamarck) Hann. [See Plate 9, page 127.]

xBrunsvigia Bidwellii (Worsley) Traub, **comb. nov.** Syn.—*x Brunsdonna Bidwellii* Worsley, in Jour. Roy. Hort. Soc. *51*:65, 67. 1926; (descr. only), J. C. Bidwell, in Gard. Chron. Lond. July 29, 1850, p. 470.

Here belong all crosses involving *Brunsvigia rosea* (Lamarck) Hann., and *B. orientalis* (Linn.) Eckl. (syn.—*B. multiflora* Ait., *B. gigantea* Heist., non (van Marum) Traub.)

2896

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